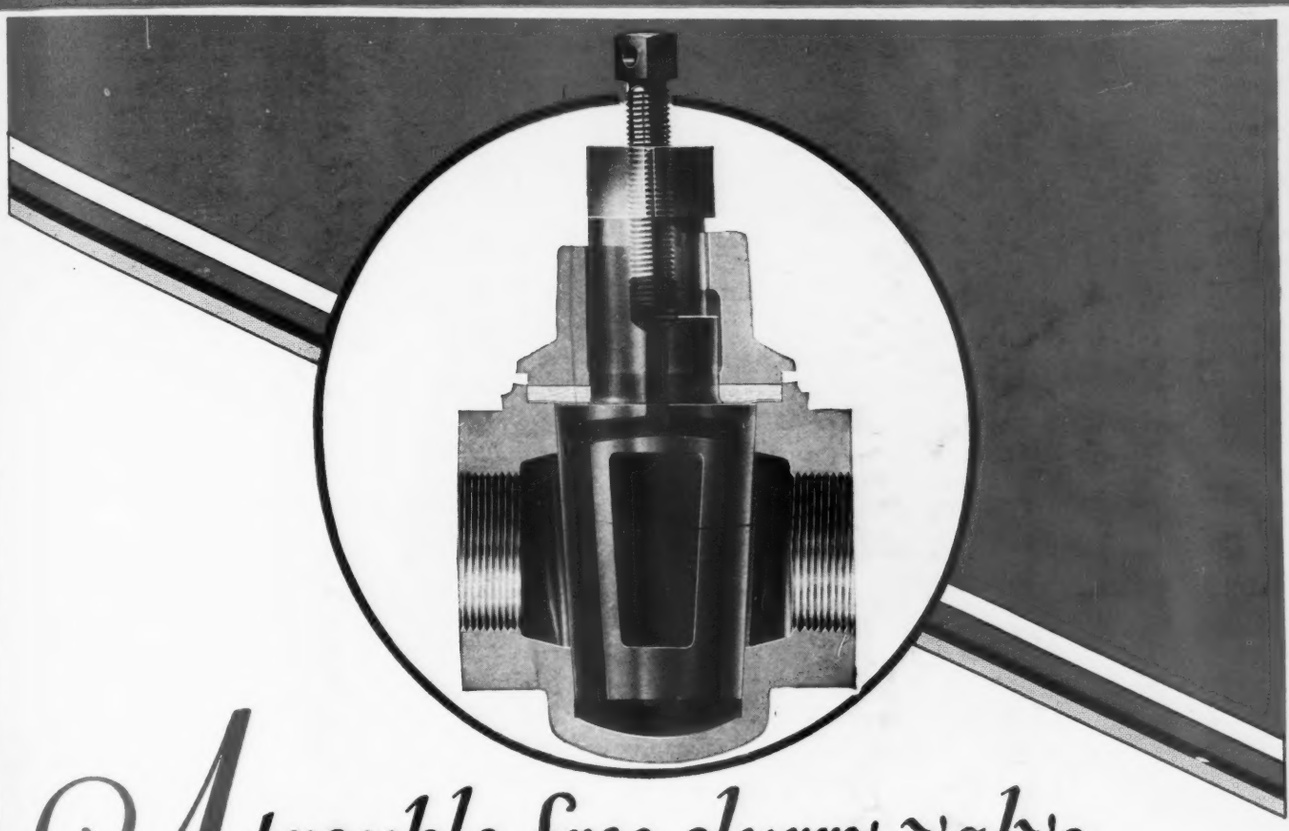
SEP 7 1926

Rock Products

With which is Incorporated **CEMENT and ENGINEERING NEWS** Founded 1896

Chicago, September 4, 1926 (*Issued Every Other Week*) Volume XXIX, No. 18



A trouble-free slurry valve

Sticking, excessive friction, leakage—all these defects have hitherto been considered more or less inseparable from a slurry-line valve. But these old difficulties are obviated in the Merco Nordstrom, the one valve in which **lubricant** serves the purpose for which **force** has formerly been employed. Applied by pressure, on the working principle of the hydraulic jack, constant and lasting lubrication in the Merco-Nordstrom Plug Valve prevents at all times, under all conditions, the occurrence of that ancient nuisance: the stuck plug. A valve that will work more smoothly and stay on the line longer.

MERCO NORDSTROM VALVE COMPANY

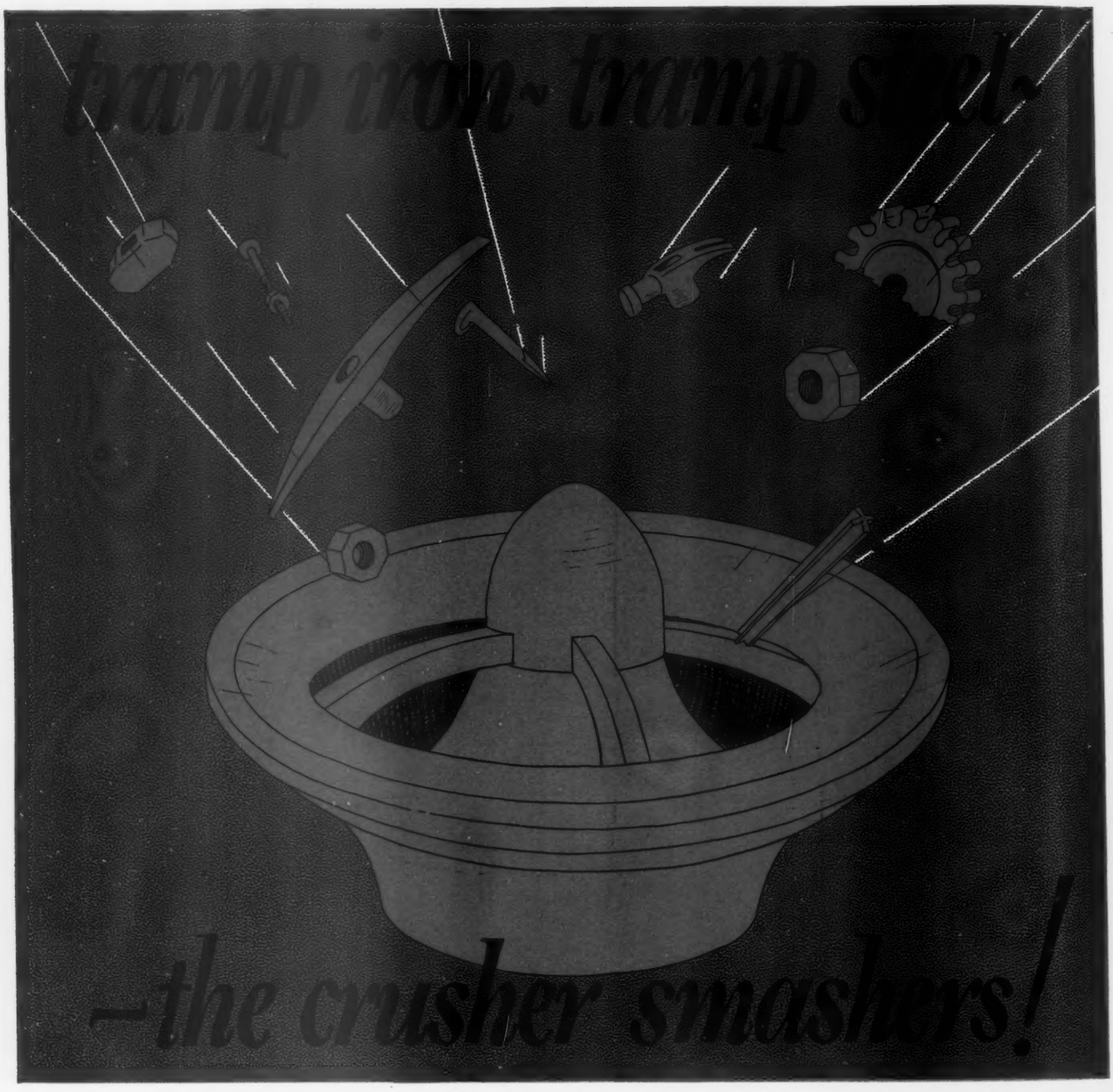
SUBSIDIARY OF THE MERRILL COMPANY

Engineers— MERCO *Manufacturers*

San Francisco 121 Second Street | New York 110 W. 40th Street | Chicago Peoples Gas Building | Houston 613 Washington Avenue | Cleveland 325 Engineers Building | *Agencies in Principal Cities*

MEMBER A.B.C. *The Only Paid Circulation covering the Rock Products Industry* MEMBER A.B.P.

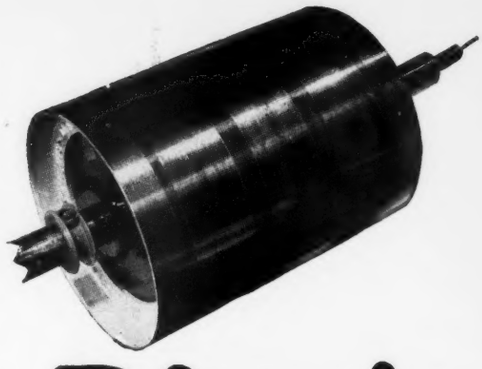
Printing of This Issue is 5200 Copies. Next Issue Will Be September 18



A VAST collection of metal ranging from the stray crusher weakening casting to the crusher destroying steel drill point is marching toward your plant.

They'll fill the "iron traps" in your crushers, if they aren't already filled with material and when the trap is full they will tear the heart out of your crushers.

A Dings "High Intensity" Magnetic Separator will effectively eliminate crusher delays caused by "tramp iron or steel."



Dings High Intensity MAGNETIC SEPARATION

DINGS MAGNETIC SEPARATOR CO.
803 Smith Street :: Milwaukee, Wis.
The largest exclusive builders of magnetic separators
New York: 52 Vanderbilt Ave. San Francisco: 419 Call Bldg.

RP9-4Gray

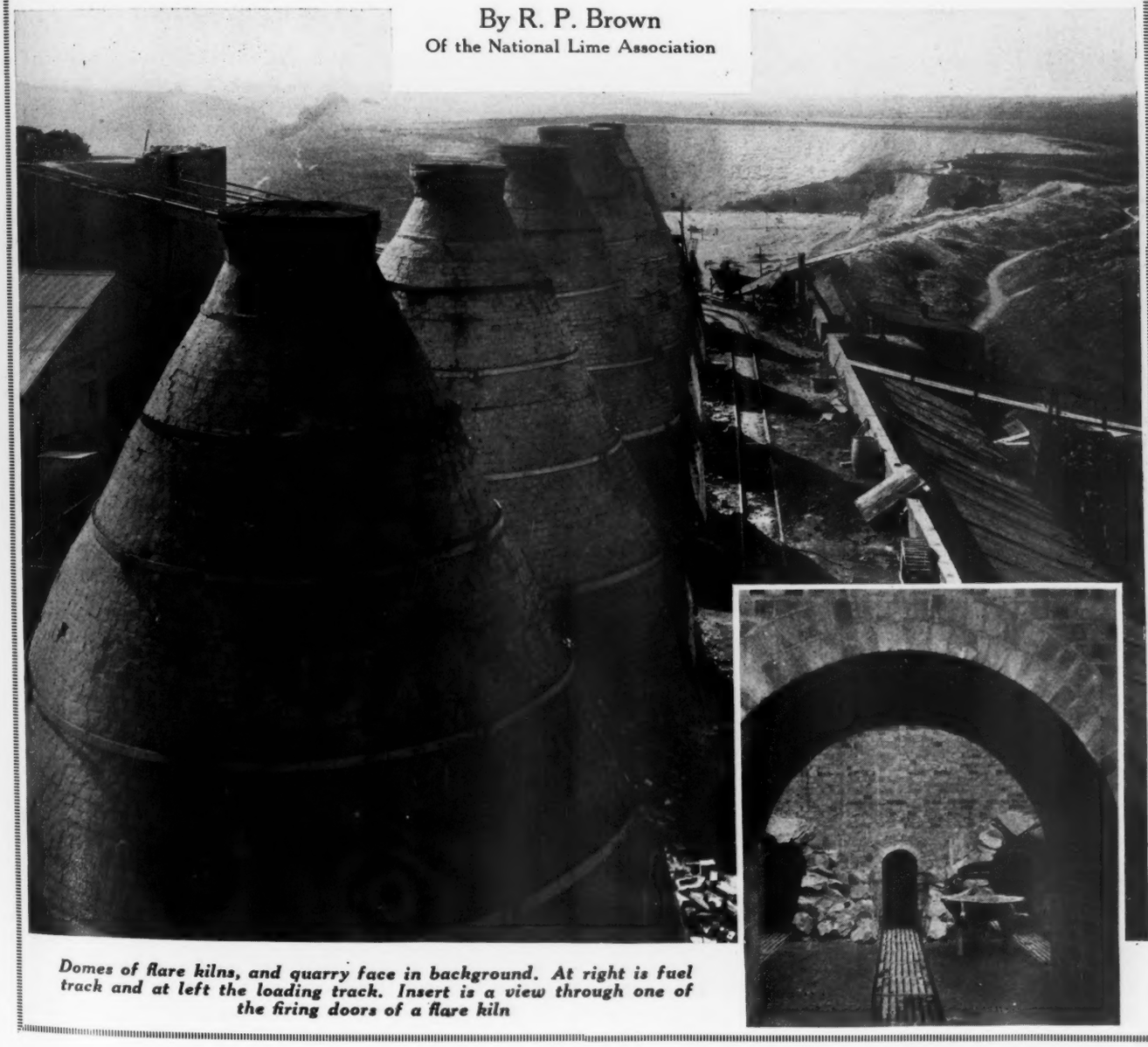
Rock Products
CEMENT and ENGINEERING NEWS

Volume XXIX | Chicago, September 4, 1926 | Number 18

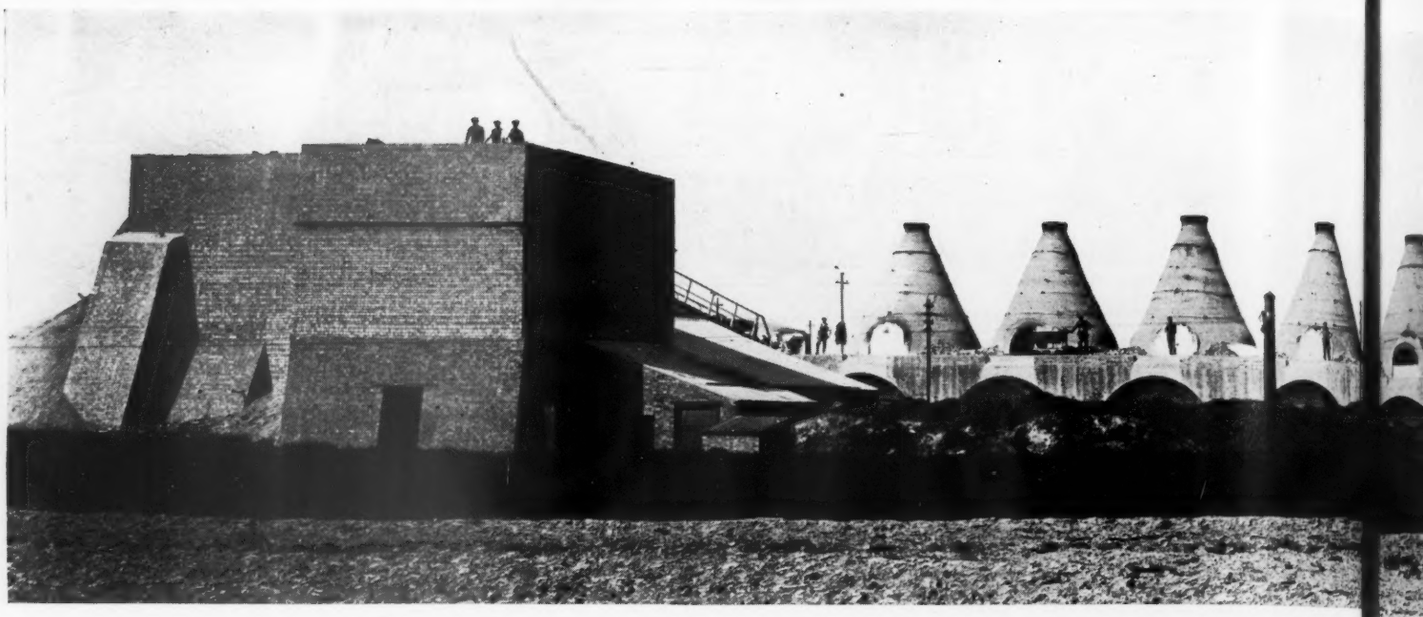
Lime Burning at Typical English Works

Quarry and Kiln Practice of Dunstable Lime Co., Operating in Greystone Chalk Near London, Inspected by American Visitor Under Guidance of Major Rowe

By R. P. Brown
Of the National Lime Association



Domes of flare kilns, and quarry face in background. At right is fuel track and at left the loading track. Insert is a view through one of the firing doors of a flare kiln



At the left are the old pot kilns, followed by the flare

MANY lime producers in the United States will recall having met Major (now lieutenant colonel) C. W. D. Rowe at the 1924 convention of the National Lime Association. It was the writer's good fortune recently to go through the works of the Dunstable Lime Co. with Col. Rowe, who was kind enough to authorize this article on his plant operation. Dunstable is a small city about 25 miles northwest of London.

This company burns stone taken from the gray layer of chalk. This carries considerable combined silica and some alumina, being known as the "greystone" or grey chalk belt. Geologically above this layer is a stratum of white chalk, containing very little silica or alumina. This upper layer is quite uniform in analysis, as is also the lower or "greystone" layer at Dunstable. The overburden in either case is usually very light, as will be seen from one of the photographs.

Although the quarry is located in the grey layer, no white chalk appearing, lime plants operating in the white chalk are only two miles away. The greystone, or grey chalk—for it is scarcely hard enough to be termed rock—is quarried by hand. As is the custom in many English lime quarries, hand labor is used quite extensively. The holes are drilled electrically, loaded with black powder and fired by fuse. Some experimental tests of other explosives are being conducted, but the customary procedure is to use black powder.

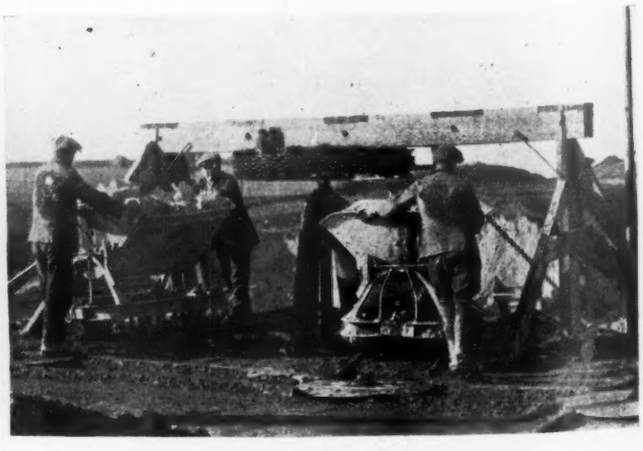
Now Drilling Electrically

The drilling was only recently changed from hand sledging to electricity, and one of the biggest problems they had to solve was the design of the bit. The ordinary type had a tendency to clog when the hole was from 25 to 30 in. deep, due to the softness of the chalk and its high percentage of moisture. However, this was overcome and drilling is now a rapid process. As soon as sufficient holes have been drilled to break the ground satisfactorily they are loaded and fired. Enough loose stone is ordinarily kept on hand to take care of the plant requirements for two or three days.

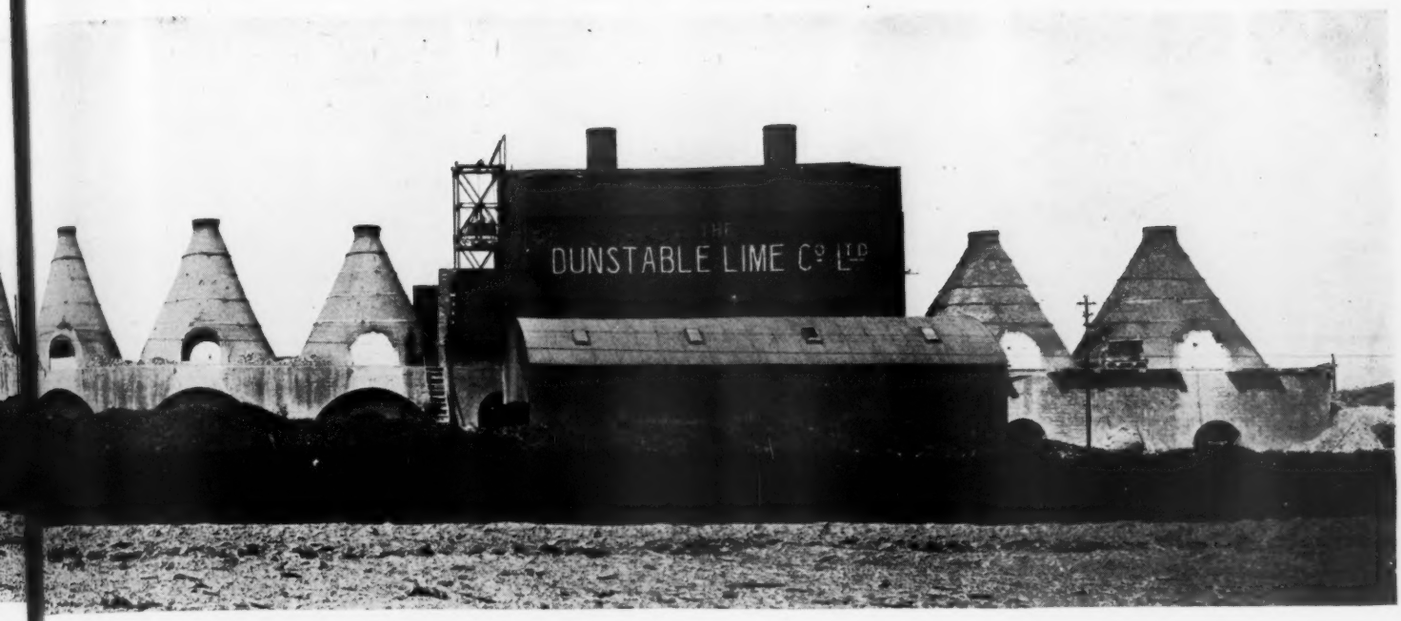
The grey chalk normally contains considerable moisture, which is in a large measure the reason for numerous small shots rather than occasional larger blasts. There are no cleavage planes and as the chalk is quite soft, black powder is used to avoid the pulverizing action of a high explosive. The slower action of black powder pushes out good-sized pieces with a minimum of fines and at the same time loosens the surrounding chalk so that it may be quarried with pick and bar at an economical rate. Ordinarily the pieces of chalk which are too large to load by hand can be broken down with a sledge or by a sledge and point, but if one is too solid a small hole is drilled in it and a light charge of black powder used to break it to loading size.

Hand loading is practiced as being the best method of securing careful grading of the stone. The product must maintain a high standard of quality and as yet no mechanical device has been found satisfactory, the principal objection being that a machine cannot discard stone that is not up to standard and also that there is more breakage than is desirable. The present practice sends only selected stone to the kilns, graded both as to quality and size.

After a blast, showing character of material



Kiln terminal of tracks from quarry



kilns and the two special kilns in the building at right

Six men handle all the quarry work, even to delivering the loaded cars to the loading incline, where a cable brings it up to the kilns.

Three Types of Kiln Used

Three distinctly different types of kilns are in steady use at Dunstable. The oldest are three mixed-feed pot kilns with heavy stone shells. These are built together, which facilitates loading and drawing and conserves heat. One is about 11 ft. in diameter and the other two are about 13 ft. across. These kilns are fed with anthracite culm, which has a heating value of about 11,000 B.t.u. per lb. and is readily available at low cost. A layer of about one ton (2240 lb.) of stone is spread in the kiln, chinked with fines and then the coal spread over the stone. A draw of about 14 cwt. (1568 lb.) is made every two hours, and loaded directly into cars for shipment. Three cwt. (336 lb.) of coal are burned to produce one long ton of lime in these kilns.

Nine "flare" kilns supply the main demand for large sized lump lime. These kilns, while not as economical in labor requirements as some other types, produce all lump lime without fines.

Ordinary Shaft Kiln Tends to Choke

Due to the soft nature of the stone, the usual shaft kiln is not satisfactory, as the product is too fine and the kiln tends to choke. These flare kilns remove that difficulty and the product is ready for shipment as it comes from the kiln, there being no fines or loss due to contamination from the fuel.

These kilns are about 16 ft. in diameter and have three grates running clear through. The lumps of stone are brought in and piled by hand in arches over each grate. The space between and over the arches is then filled in with quarry-run material, nothing smaller than 2-in. stone being used. When the kiln is filled a brick dome and short stack are closed over the top and the fires built. The dome and stack are permanent, but have arches on both sides on the upper level to facilitate drawing and charging. These openings are bricked up during burning, common clay brick laid in a lean greystone mortar being used.

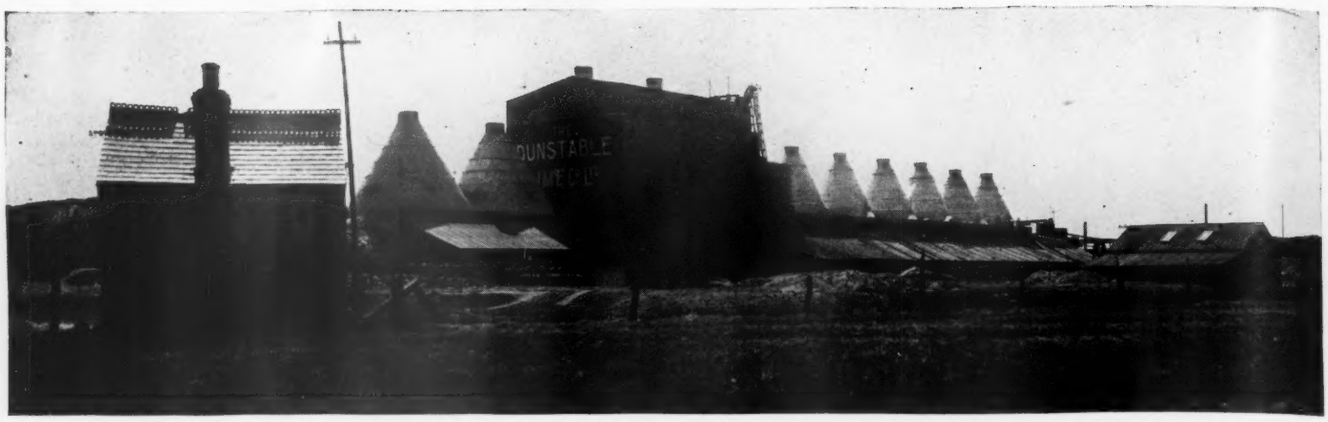
The brick work on these flare kilns, with the exception of that in the firing arches, is all common shale brick ("Flettons") laid up in greystone lime mortar. This has been found just as durable as fire brick and considerably less expensive.

These kilns range in capacity from 44 to 50 long tons (of 2240 lb.) per batch. It takes about four days to get a batch of lime from these kilns from the time that building the arches begins through the filling, burning, cooling and unloading, till ready to start loading again. About 6.4 cwt. (717 lb.) of low-grade steam coal (about 10,500 B.t.u. per lb.) is used to burn one long ton of lime, giving an efficiency rating of about 1 to 3.13. However, the lime produced is of excellent quality and is in great demand. Also, there is no loss due to fines or contaminated lime, the entire product being marketable.

Two Kilns of Special Design

Two large kilns, which are specially de-

Interior of flare kiln. Arches are built up by hand and balance of stone dumped in from above



View of kilns from side of incoming fuel track, showing elevator which feeds top of all kilns

signed modifications of the Brockham-Aalborg vertical kilns, complete the kiln equipment. The special modifications have been for the purpose of reducing the grinding action and increasing the heat efficiency, the results being very successful. The redesigned kilns are known as the Dunstable-Aalborg kilns. A vertical section through these kilns would be nearly diamond shaped, the lower point being the draw shears and the upper point connecting with the charging door and stack. These kilns are housed separately and the stone is elevated to the charging level by an electric elevator, as is also the coal.

The raw stone, mixed with a small amount of coke, is charged at the top and "smudge" coal is fed into the kiln through a series of shafts. These are arranged in two rings around the kiln, the holes in the inner ring leading to the upper portion and those in the outer ring feeding in just above the widest part of the kiln. This "smudge" fuel is very finely divided soft coal ranging in heating value from 11,500 to 12,000 B.t.u. per lb. It is practically a waste product at the mines and can be obtained very cheaply. The ratio of smudge fuel to coke varies according to the moisture in the stone and the rate at which the kiln is being pushed, but on an average the efficiency ratio of the kilns, as determined by a recent series of tests, is about 6.5 tons of lime per ton of fuel (coke and "smudge" coal).

Operator Gages the Heat

No pyrometer heat measurements are made, but the fireman has become very adept in operating these kilns and keeps the top cool and the bottom cold. He can gage the condition of the kiln closely by looking down the coal holes, which open directly into the kiln, and fires accordingly. There is practically no heat loss through radition, as the exterior walls of the kiln are extremely thick due to the loads they must sustain. Col. Rowe states that his experience has demonstrated that skilled human control is far more satisfactory than depending upon mechanical devices which can only reflect the conditions in their immediate vicinity.

The demand for lime from this plant is very steady and consequently no storage bunkers for the burned product are required. Variations in demand are at present easily handled by speeding up the rate of firing the kilns. In fact, the demand has been steadily increasing, and it has been necessary to keep the present kilns burning all the time and to build additional equipment as well.

Shipped in Tarpaulin-Covered Cars

Most of the lime is sold to the trade as lump in bulk. A spur track has been run into the plant and the lime is loaded directly from the kilns to open-top cars which hold a minimum of four and a maximum of eight long tons. These cars are covered with tarpaulins furnished at a nominal rate by the railway company, and as the hauls are generally short there is no appreciable deterioration of the product en route. On a long haul some dust is formed, but this is entirely satisfactory for construction use.

Chemical analysis of the Dunstable greystone lime shows the following composition:

	Per cent
CaO	74.38
SiO_2	9.54
Al_2O_3	6.77
Fe_2O_3	1.23
MgO	0.63
SO_3	0.70
CO_2	0.60
N_2O	0.28
K_2O	0.50
Insoluble	0.71
Loss on ignition	5.95

Microscopic examination shows that most of the silica is combined with the calcium as ortho-calcium silicate and that the balance of the calcium is in the oxide form.

When exposed to water the free quicklime hydrates and the mass crumbles to a dry powder or paste, depending upon the amount of water used. The calcium and alumina compounds function later and serve to give increased strength to the mortar.

In sections where eminently hydraulic lime, commonly known in England as Blue Lias lime, is used, the masons are familiar with handling their lime in the ground or crushed form. Such trade is supplied by crushed greystone lime and uses practically all the fines from the kilns. A small crusher is sufficient to take care of this material and to break down larger lumps if the demand for crushed lime strengthens.

Agricultural Demand Increasing

There is also a steadily increasing agricultural demand for greystone lime and during the last year it has increased heavily. The agricultural trade can use any of the lime produced, not requiring special equipment or a special product, and offers a ready market for any lime not taken at once by the construction industries.

The most common use of greystone lime is in mortar for scratch and brown coat plastering. The older villages throughout

Approach to works from quarry

the greystone region have wonderful examples of exterior stucco made from this material, but the tendency is toward masonry construction at the present time and so this company is not pushing the use of its product for stucco, although it would be particularly suitable and should find a ready market. The desired degree of hydraulicity is present, which together with the natural plasticity of the lime makes this material well worth the careful consideration of English builders and architects.

When greystone lime comes on the job it is customary to stack it up in a pile and sprinkle it with water, letting it soak up as much water as it will take, being careful, however, not to use an excess as it is easy to "drown." When the pile starts to crumble it is again dampened, covered with damp sand and allowed to stand at least four or five hours, preferably a couple of days. When required for use this mass is broken down, thoroughly mixed with sufficient sand and brought to the desired consistency. Ordinarily about three volumes of sand are used with each volume of greystone lime. There is not much trouble from under-sanding, as the desire for economy avoids that, and oversanding cuts down the plasticity so severely as to practically eliminate that difficulty. Furthermore, greystone lime has been on the market for so many generations that the mason trades are familiar with it and its properties and accordingly know how to handle and use it correctly. It fact, there is evidence that it was burnt during the Roman occupation, and at least one of the plants south of London works a quarry that was originally opened up by the Romans.

As yet no standard specifications for greystone lime have been adopted. However, the Greystone Lime Burners' Association are developing data upon which to base a satisfactory specification. It is felt that such a specification would strengthen their position with architects and engineers and at the same time extend their own knowledge of the material they produce. A sub-committee of the British Engineering Standards Association is also studying the problem, but owing to the many types of lime, their problem is difficult.

Although mortar made from this lime hardens rapidly and in the presence of moisture the lime is not sufficiently hydraulic to set when under water. Once it has hardened, however, it will not disintegrate under water and will withstand all climatic conditions admirably, making it an ideal material for mortar or stucco and particularly suitable for plastering exposed to moisture.

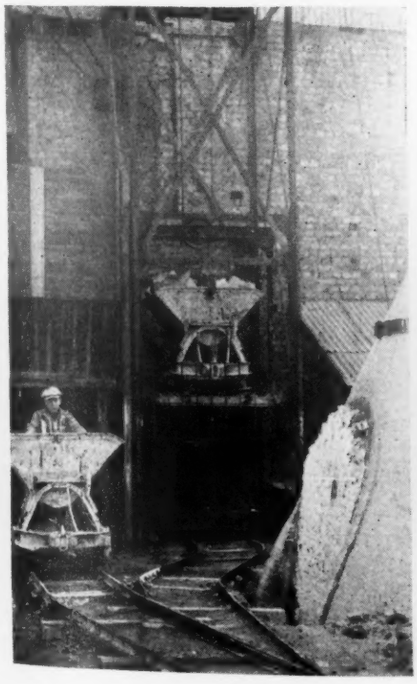
Specimens of 1:3 mortar stored in air for 30 days have a tensile strength of around 17 lb. per sq. in. and when stored in air for 21 days and then for nine days in water the strength is around 28 lb. per sq. in. The time of set of 1:3 greystone mortar, as determined by the Vicat needle test, is 12 hours in air. As yet, no English standard tests for tensile and compressive strength or for soundness of greystone lime have been recognized. Such tests will, of course, be developed as the specifications advance.

Train of lump lime ready for shipment

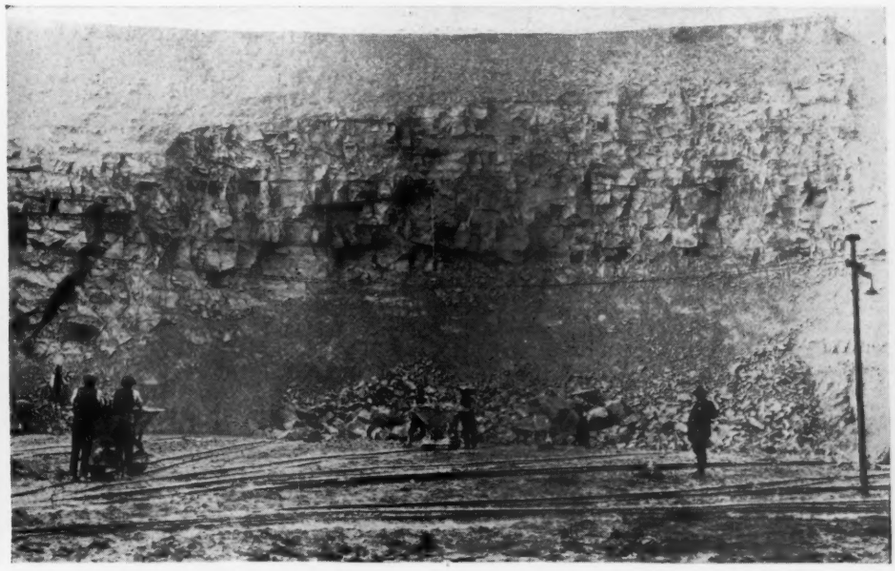
Making Progress on Hydration Processes

A number of the leading greystone lime manufacturers have been experimenting for about five years with the hydration of their product. It is understood that considerable headway has been made but no data have as yet been released for publication. The market for hydrate is not as highly developed in England as it is in America and any changes from the standard practice of centuries must be made gradually. Consequently, no attempt will be made to produce hydrated greystone lime on a commercial basis until all the problems have been solved.

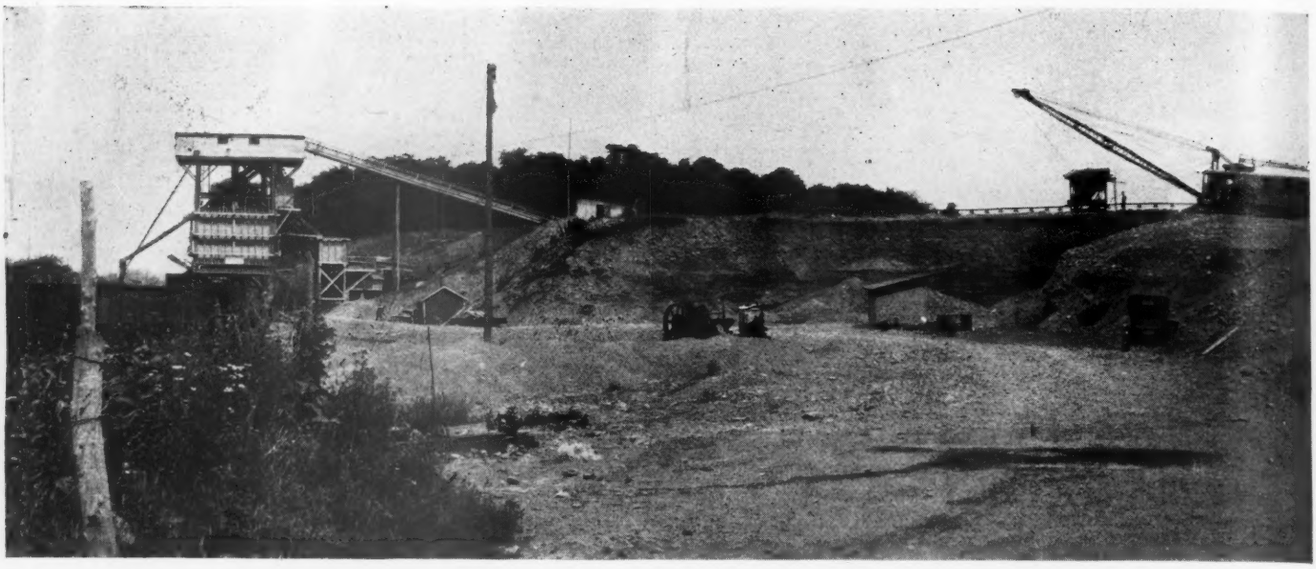
Everyone about the plant was busy and cheerful and the general attitude was apparently one of cordial co-operation. There was a healthy rivalry between the firemen handling the different types of kilns as to who could maintain the best fuel efficiency and turn out the best lime. This same spirit extended all through the ranks.



Elevator from drawing floor



Portion of quarry showing some of the subsidiary tracks to face



Showing entire operation of plant, from dragline excavation to car loading

Gravel Plant Producing Crushed Stone as Separate Product

New Plant of Madison Sand and Gravel Corp., Solsville, N. Y., Also Includes a Field Conveyor of Unusual Design

Steel framing holds bins and superstructure

THE new plant of the Madison Sand and Gravel Corp. at Solsville, N. Y., is somewhat unusual in that it was designed to produce as large a proportion of crushed stone as possible. For highway concrete in New York state, crushed stone is a preferred aggregate. As it was expected that the output of the plant would be largely absorbed in highway construction the layout of the plant was made with a view to producing sand and stone with as little gravel as possible. This called for a separation of materials unusual in sand and gravel plants, but this has been effected by such simple means that there is hardly more machinery than is found in a plant of the usual design. The original layout was sketched by C. A. Adams, the superintendent of the plant, and the design and construction were under the direction of the Smith Engineering Co. of Milwaukee, which furnished most of the machinery.

The deposit worked is of glacial origin and is said to be one of the few that may be classed as true "delta" deposits, according to a report by Prof. A. P. Brigham. At the point where it is being worked it is ½ mile wide and it runs back for at least 2 miles. Test pits have shown that it contains approximately half sand and half gravel with comparatively few large pieces, making it an ideal deposit to work. About

50% of the gravel is limestone pebbles and cobbles. The remainder is of various siliceous rocks. The face opened showed from 40 to 50 ft. of sand and gravel bottomed on fine sand, as is usual with deposits in that part of the country. All of the workings are above water level.

The manner of excavating the material and conveying it to the plant is somewhat unusual, although by no means unique. The excavator is a Monighan dragline No. 1½-W with the latest type of walking device. This has a 60-ft. boom and the hoist for the bucket and swing is driven by a 100-hp. a.c. General Electric motor through a belt. A 5-hp. Western Electric motor drives a Curtis air compressor that furnishes air to the rams on the outside type frictions. A Page 1½-yd. bucket with manganese steel lip is used with this dragline. It is of an extra-heavy type and was especially constructed for the work.

The dragline discharges the bucket into a field hopper which straddles a field conveyor of 350-ft. centers. This hopper is not the usual field hopper built on the job but a carefully constructed machine designed for the work it has to do. At the top is a 9x10 ft. grizzly of special steel bars.

Plant conveyor, main screen and elevator for crusher discharge

These steel bars are ¾-in. wide by 6-in. deep, bound together with 2-in. pipe spacers and rods. This design was adopted after failure of 4-in. wedge bars (which are the heaviest available) and also of 80 lb. railroad rails snapping under the impact of large boulders. A 9-in. clear opening prevents anything too large from reaching the 10-in. crusher.

The grizzly was originally placed at a 16 deg. inclination. This incline caused too many of the large boulders desirable for crushed stone to be wasted. The latest grizzly lies flat and a platform attached to the hopper permits a man to keep the grizzly clean and the large boulders broken without delaying the excavator.

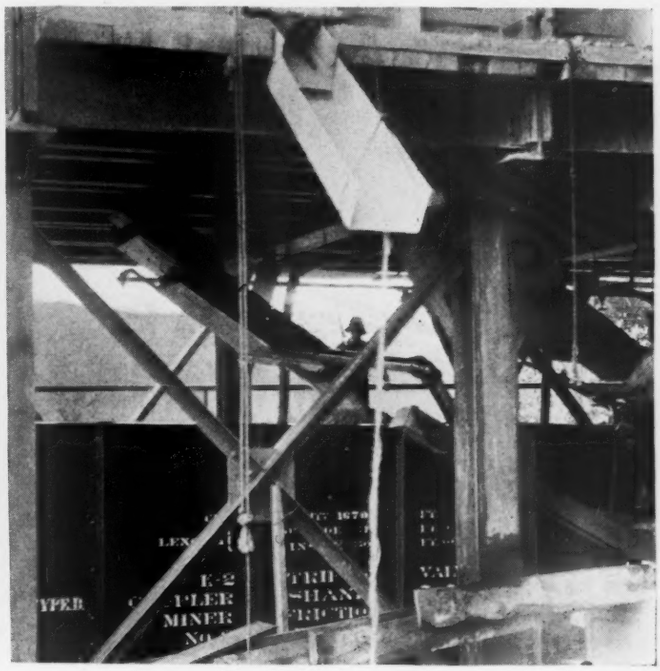
The bars are set 10 in. apart and the few pieces that will not pass are cast back into the pit with the strippings. There is only 18 in. to 2 ft. of overburden to be stripped and the dragline does this work on overtime when the plant is not running.

Below the hopper is a Telsmith reciprocating feeder driven by a motor through a Foote Bros. speed reducer of the worm type. This feeds the material from the hopper to the field belt and insures a steady feed of material to the washing and screening plant.

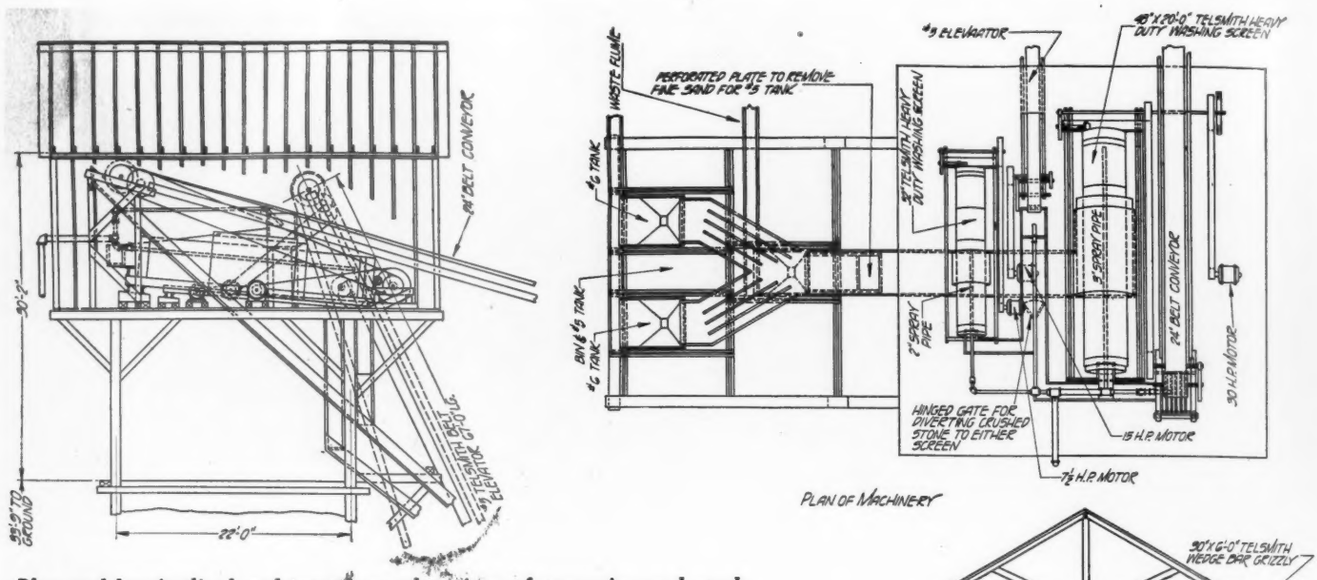
Whenever it is necessary to move the hopper the dragline has only to pick it up and set it in the desired place.

The 350-ft. field conveyor is 24 in. wide and is supported on movable timber sections that may be skidded anywhere on the flat surface of the deposit. No trouble with keeping the belt in line or running freely has been experienced. The troughing rolls and idlers are all supplied with Timken

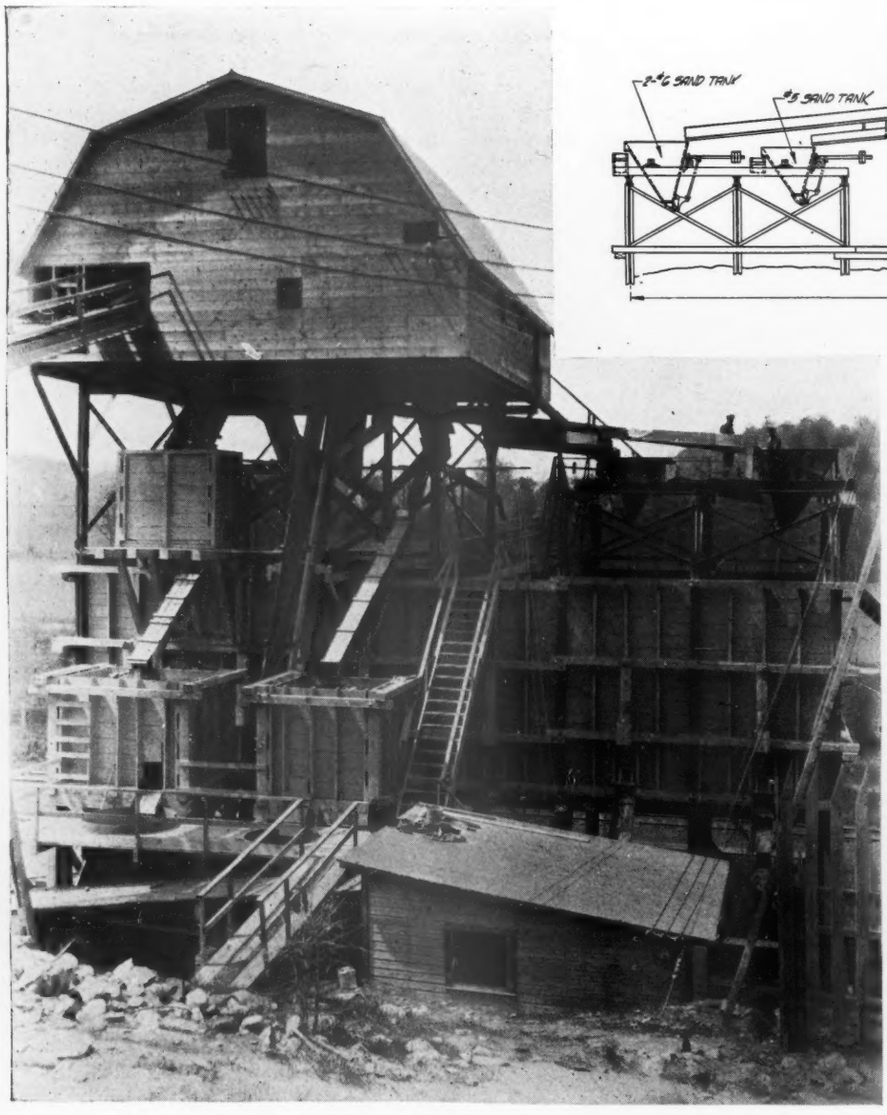
Discharge valves of sand tank



Rewashing chute under bins



Plan and longitudinal and transverse elevations of screening and washing plant of Madison Sand and Gravel Corp.



Crusher bins with return chutes and sand recovery plant

roller bearings and the belt is of Goodyear make. Both the field conveyor and the conveyor which connects the field conveyor to the plant were supplied by the Stearns Conveyor Co. of Cleveland, Ohio.

The field conveyor is driven by a 10-hp. Lincoln motor through two reduction gears. This drive is in a small house built over a turntable by which the drive and head pulley of the field conveyor may be swung around through the greater part of a circle and then bolted in place. The center of this circle is over the plant conveyor so that this will receive the feed in all positions of the field conveyor.

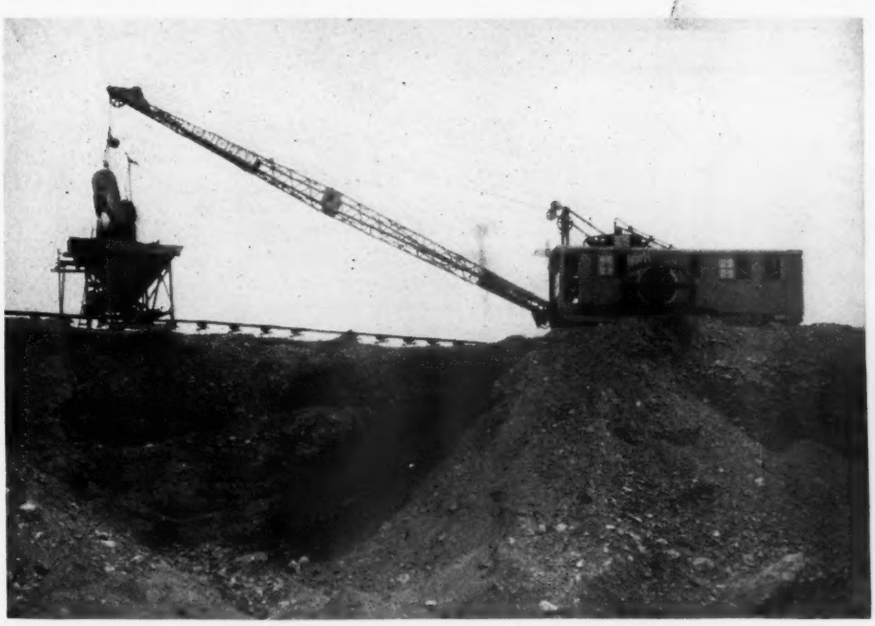
The 24-in. plant conveyor is 120 ft. center to center, and it is set at 16 deg. from the horizontal. This is about the steepest inclination that could be used on account of the large round stones in the bank material. These would roll back on the belt if it were given a steeper angle.

The frame of the plant conveyor is of 12-in. steel channels placed back to back and both troughing and idler rollers are above the channels. This frame is supported on bents 30-ft. apart.

The discharge of the plant conveyor is on a grizzly set at 45 deg. made of Telsmith wedge bars. When this grizzly was first put in the bars were set parallel to give a

End of dragline, showing walking mechanism and arm for carrying cable

Dragline dipper delivering to field hopper and field hopper to belt conveyor and thereon to the plant

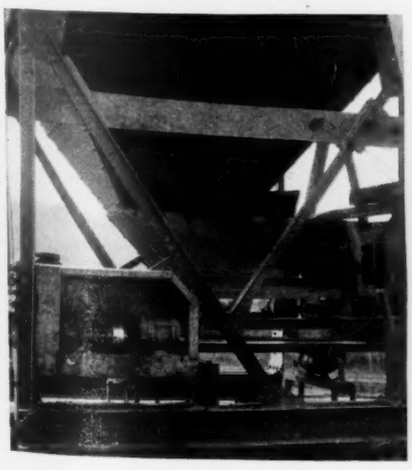


Dragline excavator feeding hopper

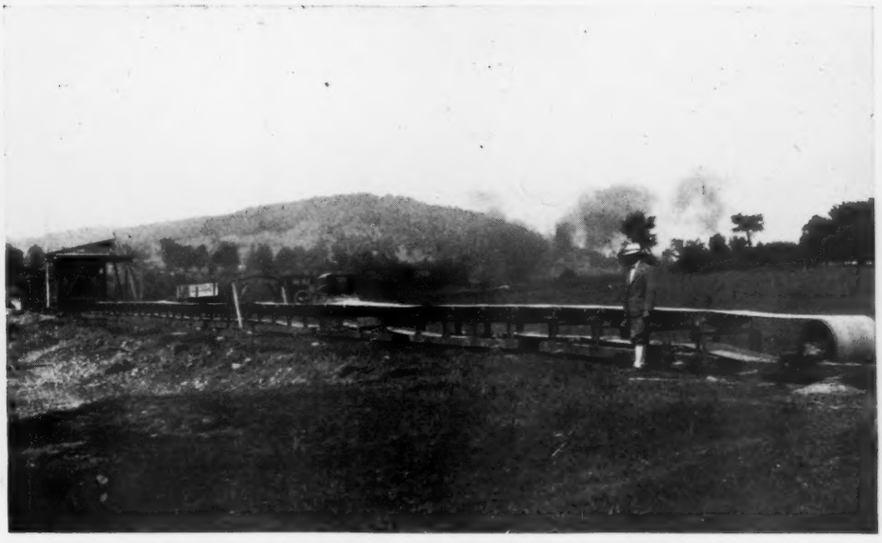
4-in. clear space all the way. Considerable trouble was caused by the wedging of stones between the bars. This was entirely cured by setting the bars 3½ in. apart at the top and 4½ in. apart at the bottom so that the space between the bars widens in the direction the material travels.

The oversize from this grizzly goes to a bin over the first crusher, a 10-in. Telsmith primary breaker. The undersize is sluiced to the main screen of the plant. This has a 6-ft. scrubber section, a 10-ft. section with 1½-in. round holes and a 4-ft. section with 2⅞-in. round holes. There are two jackets. The inner one, 9 ft. long, has ¾-in. holes; and the other, 8 ft., has 5/16-in. holes. The oversize of this screen goes to the 10-in. primary crusher just mentioned through a box that breaks the fall of the stones. The sizes from 1½-in. down go to bins, except the sand which passes the 5/16-in. holes of the outer jacket. This goes to the sand recovery plant. The size between 1½-in. and 2⅞-in. is usually sent to a secondary crusher.

It will be seen from this that all material



Roller feeder and drive under field hopper



Field conveyor 350 ft. long taking material from field hopper to main plant

Junction of field conveyor and plant conveyor

which will not pass a 2⅞-in. round hole goes to the primary crusher. The discharge of this crusher goes to an 18-in. bucket and belt elevator which, by a split chute, may discharge either to the main screen or to a second screen called the crushed stone screen. The usual practice is to send all the crusher discharge to the crushed stone screen.

John G. Carpenter, president

This screen is 32 in. in diameter and 13 ft. long. There is a 4-ft. scrubber section, a 4-ft. section with ¾-in. round holes and a 6-ft. section with 2¾-in. round holes. There is a jacket 3 ft. long with 5/16-in. round holes. The material passing this jacket goes to the sand recovery plant and the oversize goes to the secondary crusher of the plant, which is an 8-A Telsmith, and which also takes the minus 2⅞ plus 1½-in. material from the main screen.

Both crushers discharge to the same elevator, thus putting the secondary crusher in closed circuit with the crushed stone screen.

An elaborate system of steel spouting with adjustable gates makes possible the proportioning of any desired mix of gravel or stone in any of the four coarse aggregate bins.

All the sand (minus 5/16 round hole) from both screens goes to a steel chute 24 in. wide with all the water used in washing. It passes over a perforated plate with ⅛-in. by ½-in. slots. The undersize taken out by this screen is used for mason's sand and plastering sand, and the amount taken out is regulated by blanking off part of the screen with a steel plate.

Sand is collected in three Telsmith automatic sand tanks, one No. 5 which collects the fine sand and two of No. 6 size which collect the concrete sand. The discharge of these tanks goes to 30-in. Lewistown sand washers, arranged in pairs, the material passing through the first of the pair and then flumed to the second with clean water. These sand washers rinse the sand thoroughly beside removing any clay balls or soft pieces that may be present.

The bins and the superstructure that holds the machinery above them are very substantially constructed. The bins are supported on 12-in. steel H-beams over an 18-ft. span. These beams are cantilevered out 2 ft. beyond the supporting columns on both sides, giving 4 ft. more bin space. They are supported on 30-in. bridge I-beam girders, which are about the largest rolled sections made. The steel columns are set on a concrete wall 2 ft. wide at the top and carried out to a 6-ft. width at the bottom, which is set below front line. The gates in the bottom of the bins are of the Simplex type and Telsmith quadrant gates are used on the side. Below these gates are rewashing or rinsing chutes with screen bottoms so that all gravel and crushed stone is given a final rinse before being loaded on trucks or cars.

Cars are loaded beneath bins and also on one side, while trucks are loaded on the other side, thereby getting maximum capacity from bins. Scales are installed for weighing the material trucked.

C. A. Adams, superintendent

Water for washing is obtained from a 6-in. Gould pump direct-connected to a 50 hp. motor running at 1800 r.p.m., supplying 1000 g.p.m.

The electrical equipment of the plant is as follows: Power is received through three 75 k.v.a. General Electric transformers 4600 on the high side and 440 on the low. The plant units are driven by the following motors, all of which are of the induction type, made by the Lincoln Electric Co. The plant is completely equipped with flood lights to operate at night, a separate 5-kw. transformer furnishing 100 v. for this purpose. 900 r.p.m.

Main washing screen and plant conveyor 20 hp. motor with a Jones friction clutch between the units to facilitate starting under load. Crushed stone screen, 5 hp. Bucket elevator, 10 hp.; Lewistown sand washers, 30 in., 15 hp. All these run at 900 r.p.m.

Primary (10-A Telsmith) crusher, 25 hp.; secondary (8-A) crusher, 20 hp. These run at 1200 r.p.m.

The field conveyor feeder is run with an Allis-Chalmers roller-bearing type induction motor, 1½ hp., 1200 r.p.m. The field conveyor is run by a Lincoln 10 hp. motor at 900 r.p.m.

The remaining motor units have been specified in the text above.

Any and all plant units can be stopped instantly from several points around the plant by electric snap switches.

The plant was erected in an unusually short time. Ground was broken on March 1, and by May 20 everything was ready to run. Actual operations were delayed until the first of June by waiting for power connections to be made.

Advantages of Location

The plant has a number of advantages of location, being close to the water, the railroad, and within 100 ft. of water power. It has ½ mile of gravity siding, with three other sidings near and used. With all this siding space, car storage is used as much as possible without accumulating demurrage.

The plant expects soon to purchase a crane with clamshell bucket for loading cars and for excavating in case of accident to the Monighan dragline.

A Fordson tractor and Ford dump truck are used for light work about the plant.

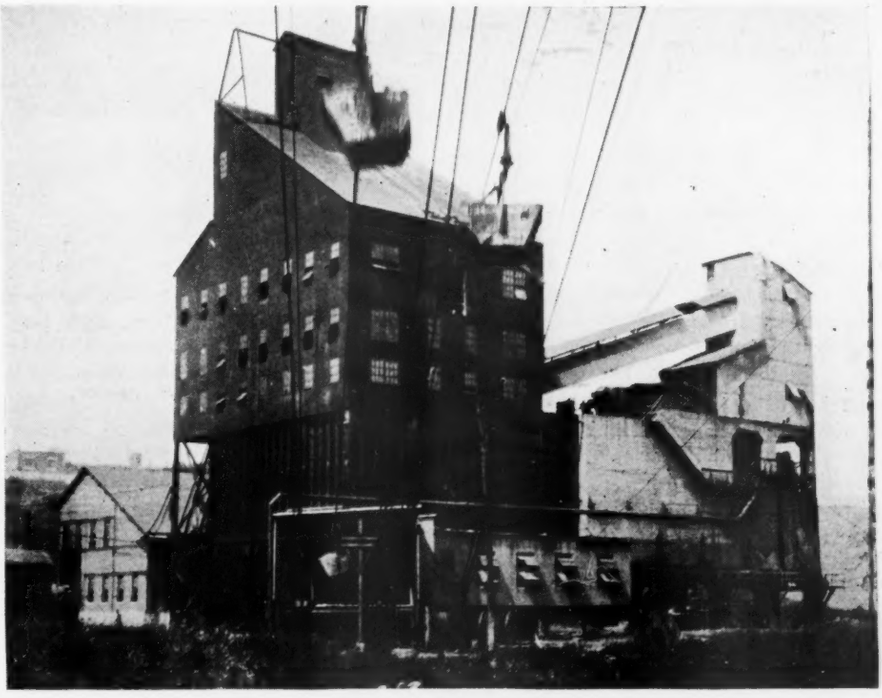
The main office of the Madison Sand and Gravel Corp. is at Hamilton, N. Y. John G. Carpenter, president of the company, is well known to the sand and gravel industry, as he is secretary of the Empire State Sand and Gravel Producers' Association. R. E. Brooks, of Hamilton, is secretary, and H. O. Whitnal, professor of geology at Colgate University, Hamilton, is treasurer. C. A. Adams, plant superintendent, was formerly in charge of a plant at Rockford, Ill., and afterwards of the Ballina Sand and Gravel plant near Syracuse, N. Y., now operated by the Rock Cut Stone Co.

Bethlehem Steel Co. Has Near-By Quarry for Flux and Commercial Stone

Washing Plant and Other Unusual Features Make This Plant at Bethlehem, Penn., of Particular Interest

THE Bethlehem Mines Corp., Bethlehem, Penn., is a subsidiary of the Bethlehem Steel Co. It operates quarries at Bethlehem, Steelton, Hanover, Naguiny, Lebanon and Bridgeport, Penn., and a quarry at McAfee, N. J. The Steelton quarry of this company was described in ROCK PRODUCTS for March 7, 1925. Although operated by the same company and under the same management, the Bethlehem and Steelton quarries and crushing plants differ greatly in equipment and methods, due to differences in the nature of the rock and the deposit which is quarried; and the other quarries are said to differ in details from both of these.

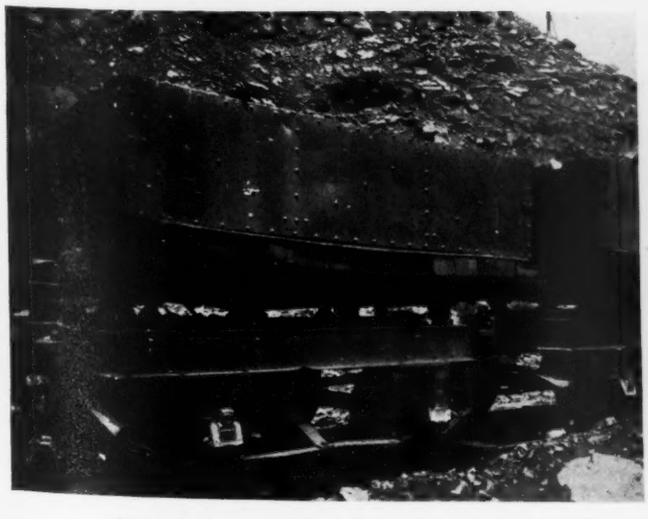
The Bethlehem quarry is situated at one end of the great steel works which stretches its length through Bethlehem for 5½ miles. The products of the quarry are flux stone and washed crushed stone for commercial uses. Most of the quarry product has to be delivered on the other side of a river to reach the mill, and an aerial tramway has been found the most economical method of transportation for this purpose.



Plant as it appears to one standing below the tramway, with buckets coming and going

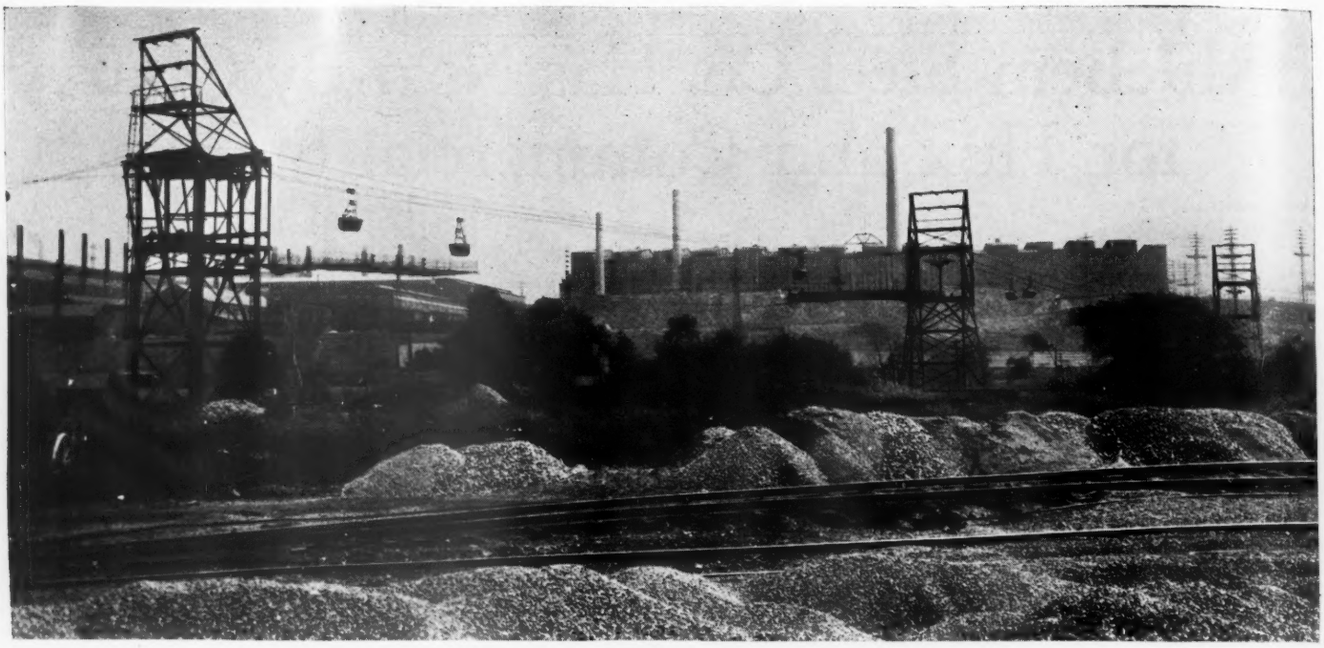
The quarry face is perhaps ½ mile long and 95 to 100 ft. high. It is worked by the usual method of putting down well-drill holes and blasting them in a group. Loomis "Clipper" drills put down the holes which gage 5⅝ in. and the bits for these drills are sharpened on a Gill machine. The average drilling is from 27 to 30 ft. per day per drill.

Only a single row of holes is put down and they are set 12 ft. apart and from 18 to 40 ft. back from the face. They are kept back to avoid the danger of sliding. The loads are of 60% Trojan powder below and 40% powder of the same make above. The loads are interrupted for two reasons. One is that separated small charges of high-strength powder give better fragmentation, the other is that mud seams may be dodged and powder is conserved by not loading the holes oppo-



Special car body floated on spiral springs

Springs rest on cylinders shown at left



Tramway which takes the product across the river

site to a seam. Cordeau is used to detonate the shots.

Before quarrying the ground is stripped by a Bucyrus dragline excavator. This has been changed from a gas-driven to an electrically driven machine by the installation of a 50-hp. Westinghouse motor.

The rock is mainly quarried for use as flux. One usually thinks of flux as a high calcium stone but this rock is a dolomite, or nearly a dolomite, containing from 38% to 40% of $MgCO_3$. The strata lie at a pitch varying from 10 deg. to 15 deg. from the horizontal. The rock breaks well and by the method of blasting described the fragmentation is so good that comparatively little blockholing is required.

The broken rock is loaded into cars by two very large electric shovels (No. 103-C Bucyrus). These were originally used on rails, but they have been mounted on heavy traction wheels which were especially built for them by the Inland Engineering Co. This type of traction is well liked for these large shovels. Any small pieces of rock which get in the way of the wheels are crushed flat by the great weight of the machine.

The shovel has a direct-current motor working at 550 volts. Power is supplied from a General Electric rotary converter placed a considerable distance away in the compressor house and connected through a standing line and cables.

The cars are of an unusual design which has been worked out by the company, and were built to order by the Magor Car Corp. The peculiarity of these cars is that the body is "full floated" on spiral springs. There are six of these springs, three on a side, and each is in a cylinder with a piston below connected to the car body. The springs absorb the shocks of loading and transportation and give the car a considerably longer life than it would otherwise have. Each car holds 6 yd.

Cars are pulled in to the crushing plant by three steam locomotives. Two of these are 40-ton Vulcans and the third is a 35-ton American. Older Baldwin and American locomotives are used as reserves.

The cars are side dump and on reaching the plant they are pulled over by hooks suspended from a crane. A small hoist serves to handle large pieces of rock. The rock falls to the hopper of the primary crusher, which is a 48x60-in. Allis-Chalmers jaw crusher, amply able to care for the largest pieces. The jaws are set to an 8-in. opening at the discharge. The primary crusher is driven by a 150 hp. induction motor. The secondary gyratory crusher is driven by a 100 hp. motor and both motors are of Allis-Chalmers make.

Loading station for aerial tramway

Oscillating feeder to screens

End view of plant with skipway and return chute to crusher at left

All the material from the quarry passes through the primary crusher and goes to a bin below the ground level. From this it is loaded into two 8-ton Allis-Chalmers skips run in balance with a 125-hp. Allis-Chalmers motor. These skips have accelerating and de-celerating counter-balances. The ropes to the counter-balances run over eccentric pulleys so that the weight of the counter-balance will check the speed of the skip as it reaches the bin and accelerate its speed as the hoist raises it. The skips discharge to a bin from which the broken rock is fed to three screens set in parallel. The oversize of the screens goes to a 35-ft. belt which runs across the building. Then it falls on a 70-ft. belt which travels lengthwise of the building. Then it goes by chutes to a No. 8 Allis-Chalmers gyratory crusher set to 3 in. The intermediate size, which is between 2¾-in. and 6-in., goes to the flux bins. The undersize which is all that passes the 2¾-in. round holes of the screen is sent to the washing plant. The screens are all 60 in. in diameter and 24 ft. long. They are driven, with the accessory machinery, by a 100-hp. Allis-Chalmers motor through belts.

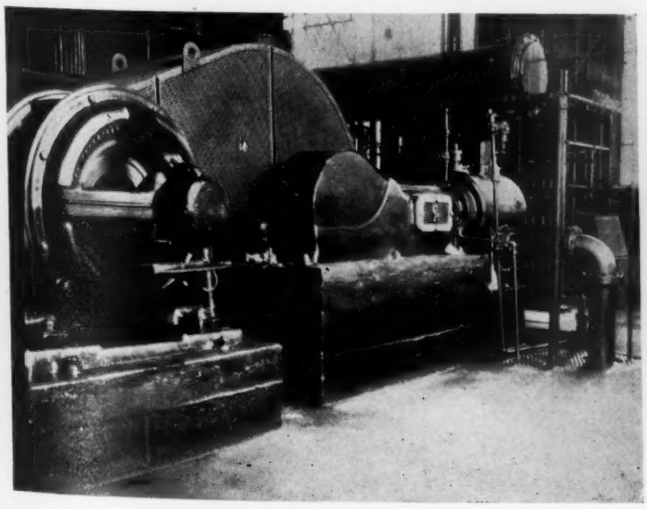
Connecting the bin and the screens are oscillating feeders adapted to handle large size pieces which insure a steady feed to the screens.

The 36-in. belts that handle the oversize are of a heavy duty type with five troughing rolls. They were built by the Stephens-Adamson Co.

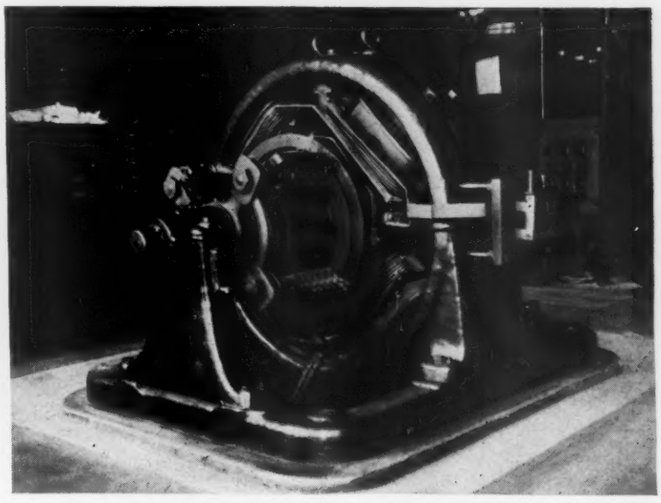
The fines from these screens (from 2¾ in. down) go to the washing plant by two 36-in. Robins conveyors. One of these is a cross conveyor under the screens and this feeds to the second conveyor which is in a gallery at the screening and washing plants. The washing plant was designed by the Bethlehem Mines Corp., after a great deal of study to find the best methods of washing limestone. The plant is entirely successful and it treats not only the current product but the waste from former operations when the plant was run only for producing flux stone.

At the washing plant the material goes first to a hopper from which an oscillating feeder sends it to a Traylor scrubber, 6 ft. in

Skipway with 8-ton skips



Air compressor and motor



Rotary converter supplies current to shovel

Quarry face, 100 ft. high, showing dip of the strata

diameter and 20 ft. long. This is a cylinder with chilled iron lifters on the inside. These not only lift and turn the stone but at the same time they work it through the cylinder to the discharge end. Water to the amount of 1500 g.p.m. is added at the scrubber. The overflow, which is at the opposite end from the discharge of washed material, carries away all the clay, excess water and other unwanted matter, leaving the stone so that only a rinse is required to have it perfectly clean.

This rinse is given in the sizing screen into which the scrubber discharges. This screen is 60 in. by 24 ft. and has 1¼-in., ⅝-in. and ¼-in. holes. Hence four products are made: oversize from 2¾-in. to 1¼-in.; intermediate between 1¼-in. and ⅝-in., and between ⅝-in. and ¼-in.; and "sand" which is all that passes the ¼-in. screen. It is locally called sand because its principal use is as fine aggregate in making concrete.

The sand is washed in three drag-conveyor boxes—that is, long boxes which have 36-in. drag-conveyors running through them to pull out the settled sand. All the sand and water goes to a large box and the product of this box goes to two smaller boxes. The rinse water from the screen (150 to 200 g.p.m.) is used to rinse the sand in these boxes and it is so clear that it is hardly colored with clay. After rinsing the sand it is sent to waste but even then it does not carry very much clay. Being thoroughly rinsed in the manner described, all the products of this plant are remarkably clean.

Loading cars with 3 1/2-yd. dipper

This washed limestone sand is a preferred aggregate wherever any concrete work is done in the vicinity of Bethlehem in which mortar strength is the important consideration. It gives a considerably higher strength test than some of the natural sand which is found in the Bethlehem market, as it shown by the following 7-day tests:

TENSILE TEST

	1-3 Mix. Lb. pr. sq. in.	1-2 Mix. Lb. per sq. in.
Ottawa sand	194	268
Natural sand	184	212
Limestone sand	230	298

Steam dinkeys pull in quarry cars

Rail shovel re-mounted on traction wheels

Machine shop and compressor house

Primary crushing plant and flower bed

COMPRESSIVE TESTS ON 2x4-IN. CYLINDERS

	1-3 Mix. Lb. pr. sq. in.	1-2 Mix. Lb. per sq. in.
Ottawa sand	875	1510
Natural sand	710	1450
Limestone sand	1570	2200

The reason for the high strength in both tensile and compressive tests is shown by the grading, which shows the limestone sand to have a fineness modulus of 3.60 as against a fineness modulus of 2.28 for river sand.

	Natural Sand	Limestone Sand
On 100 Mesh	95.8	95.7
On 48 Mesh	80.7	88.1
On 28 Mesh	38.1	77.0
On 14 Mesh	13.7	62.6
On 8 Mesh	.2	35.7
On 4 Mesh	.0	1.4
On ⅜ Mesh	.0	.0
Fineness Modulus	2.28	3.60

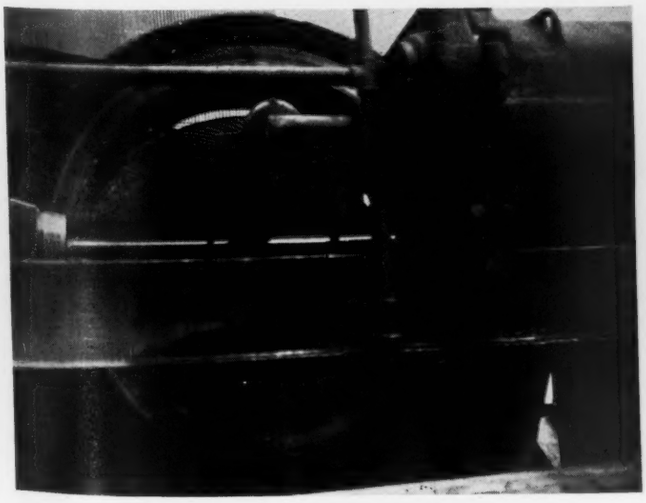
The products of the plant are conveyed across the river by a tramline 1875 ft. long. The entire equipment for this was furnished by the American Steel and Wire Co. This method of transportation was compared with several alternatives and was found to be much cheaper than any other. It costs about one-sixth as much as it would to load the material on cars and take it around by rail. The system of loading the buckets is unusually good. A belt conveyor extends along the washing plant bins so that any size or mixture of sizes may be delivered to this belt. The belt discharges to the tramway buckets. Flux is loaded from three measuring chutes connected to the flux bins. This tramway installation impresses one as excellent in every respect. The loading of the buckets is very fast and the whole operation goes like clockwork.

M. L. Jacobs, manager of quarries (right), and J. P. Peacock, superintendent

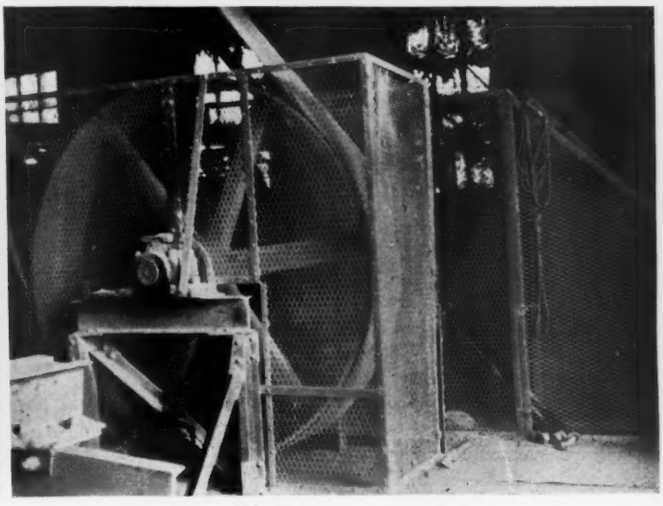
Adjoining the plant is the compressor house and machine shop. These are in a long brick building which is well lighted by long windows at the sides. The compressor house contains a 1,000 cu. ft. Chicago Pneumatic compressor driven by a 100-hp. General Electric motor at 750 r.p.m. In the same room with the compressor is the General Electric synchronous rotary converter that supplies direct current to the shovels. This has an output of 300-hp. The machine shop is equipped with everything necessary to make any ordinary repair.

The housing of this plant is of the best. The primary crushing plant is in a brick building with steel frame and concrete floors. The main building is steel frame with steel siding. The washing plant and the bins under it and the tramway terminal are all of steel and concrete construction. Everything about the plant is kept as neat and clean as possible. There is even a stretch of lawn and a pretty flower bed in front of the primary crushing plant.

The office of the company is in the general office building of the Bethlehem Steel Co. at Bethlehem. M. L. Jacobs, manager of quarries for the Bethlehem Mines Corp., has his office here and is in charge of this operation, together with the four other Pennsylvania quarries and the quarry in New Jersey. J. P. Peacock is superintendent of the Bethlehem quarry.



Washing screen and enclosed gear drive



Protection for screen drives

Highway Departments Test Road Materials

State Laboratories Make Important Contributions to Our Knowledge of Rock Products

A RECENT issue of *American Highways* is devoted wholly to reports from various state highways laboratories, showing what each is doing in the way of testing materials and construction methods for highways and bridges. A considerable proportion of these reports does not bear directly on the rock products industries and hence it is omitted in the following extracts. Among the omitted tests are those on sub-bases, culverts, wear on road surfaces and the like. The abstracts by states are:

CALIFORNIA

Mr. Pope, construction engineer, and C. L. McKisson, materials and research engineer, have developed practices in the design of mixtures and control of concrete during the last year which have resulted in average compressive strengths of 4300 lb. per square inch for several thousand field specimens. This result has been secured without picking the brand of cement used and with no increase in the amount of cement, which is fixed at six sacks per cubic yard.

Calcium Chloride for Laying Dust

Both calcium and magnesium chlorides have been tested for dust laying, with marked benefits, but the treatment must be kept up from year to year. The cost for a 20-ft. road is $900 per mile the first year and $300 per mile for subsequent years.

ILLINOIS

Effect of Gradation of Coarse Aggregates

The effect of gradation of concrete aggregate was studied to find out if reduction of the maximum size specified affects the strength of concrete. Both gravel and stone were tested. Apparently the principal criterion of strength, so far as coarse aggregate is concerned, is *regular* and *uniform* grading from the largest size to the smallest. The maximum size does not appear to regulate the strength.

Effect of Stone Dust on Concrete

Specimens were made for 180 transverse and 162 compressive tests to determine the effect of stone dust in concrete. Dust was added in percentages of 1, 2, 3, 4, 5, 6, 7 and 8% by weight. In general a decrease in strength was noted for increasing percentages of dust, the effect on the compressive strength being most marked.

Concrete made from 16 brands of cement used in Illinois showed a rather wide range in both transverse and compressive tests. The investigation, which includes chemical analyses as well as physical tests, is still under way.

Freezing and thawing tests are being conducted on representative samples of crushed stone used as aggregate in Illinois highway construction. A freezing box of the A. S. T. M. specification design, as used in testing drain tile, is used. Tests are also applied to concrete specimens.

Variation of the Sodium Sulphate Test

A comparative method for using the sodium sulphate test on gravel has been devised. A sample is subjected to the sodium sulphate test and then soaked in water to remove as much as possible of the salt. This sample and an untreated sample of the same material are separately tested in a Deval machine with slotted barrel, using the usual charge of six steel spheres for abrasion. It is hoped that some such combination test will give a means of gaging the durability of the material as well as the percentage of safe and inferior particles.

PENNSYLVANIA

Compounds of calcium chloride and water and a compound of calcium chloride and calcium oxide were tested for compression. All admixtures increased the strength of the concrete at two days. A full report is available.

Tests on high alumina cements were made to determine their efficiency in highway concrete. The full details are given in the 1925 proceedings of the A. S. T. M., Part II, Technical Paper, p. 192.

Effect of Fine Coal on Mortar Strength

Tests were carried out on mortar made of well graded normal river sand to which from 2% to 10% of fine bituminous or anthracite coal had been added.

It was found that the strength of mortars was decreased by the addition of fine coal, less by the addition of anthracite than bituminous coal. Four per cent of anthracite coal decreases the strength of mortars 8% in tension and 3% in compression. Four per cent of bituminous coal decreases the strength of mortars 16% in tension and 13% in compression. A full report is said to be available for distribution.

Concrete made with slag, sandstone and limestone coarse aggregates was tested for absorption. That made with slag coarse aggregate showed a higher absorption than concrete made with either sandstone or limestone.

A series of tests was made to determine the influence of the grading of fine and coarse aggregates on the resulting volume of concrete. (The significance of this is that where the "yield" is greater the actual percentage of cement in the concrete is less.—Ed.) A 1-2-3 mix by volume was made in all tests and aggregates corresponding to the minimum, average and maximum variations in the grading allowed by the Pennsylvania highway specifications were used. It was concluded that variations in the grading of the coarse aggregate had more effect upon the cement content than variations in the grading of the fine aggregate. But under the Pennsylvania highway specifications the maximum variation in cement content, due to variations in the grading of aggregates, could not exceed 5%.

Determining the Resistance to Abrasion of Different Classes of Stone

A standard Deval cylinder and a modified Deval cylinder with slots to allow the dust made during the test to escape were used.

It was concluded that the slotted cylinder gave more reliable data than the plain cylinder. It is possible with the slotted cylinder to determine with more accuracy the difference between a medium soft and a very soft stone. The slotted cylinder tends to reduce the personal equation.

LOUISIANA

Since Louisiana is a heavy producer of asphalt and gravel, and does not produce other road materials in any large amount, the testing work is confined to roads in which these materials are combined. Tests are being made: To determine the adaptability of gravel roads as bases for asphaltic pavements; to secure information relative to design of asphaltic pavements; to determine the adaptability of Louisiana gravels for use in such pavements, and the comparative efficiency of various types of asphaltic surfaces. Types for 12 sections have been decided upon.

MINNESOTA

Effect of Shape of Aggregates

The principal aggregate used in some parts of Minnesota is gravel with hard smooth pebbles. Experiments were made to determine the relative strength of concrete made with this gravel and concrete made with a rather angular absorbent crushed rock as aggregates. The water-cement ratio and the fine aggregate were the same in both cases. The results showed very little difference in compressive strength but a considerable difference in tranverse strength in favor of the rougher aggregate.

KENTUCKY

Kentucky has vast deposits of sandstone, ranging from very soft to hard, which have not been worked much for road materials. A series of tests have shown that any

sandstone with a percentage of wear of 15% or less could be satisfactorily used for both coarse and fine aggregate. Specifications have been prepared governing the use of this material. The fine aggregate made from sandstone has to be graded and washed.

Sandstone is very absorbtive and takes up bituminous compounds readily. Soaking in a cut-back asphalt bath and baking 15 min. to drive off volatiles makes better concrete aggregate of the soft and medium sandstones. Experiments are being made to determine the fitness of sandstones for bituminous pavement aggregate.

Limestone Screenings

Tests on the use of limestone screenings are being made. Samples are weathered to see the effect on concrete made from screenings which contain shale. Tests on frozen concrete have disproved the theory that it will develop full strength after thawing. Tests on dirty aggregate are being held to determine the strength of concrete made from it after one year and later.

Kentucky is a great producer of rock asphalt, and considerable waste is made at the rock asphalt quarries. The highway department is studying the whole subject of rock asphalt paving and has some hopes of finding a method of utilizing this waste.

IOWA

Effect of Shale in Aggregate

A series of tests of importance to the whole aggregate industry is being carried out by the Iowa department to determine the effect of shale in coarse aggregate. The most serious effect noted has been the spalling of the finished surface due to the absorption of water and consequent expansion of the shale. It was found that even small amounts of shale affect the strength of concrete to some extent. The effect of "rotten stone" in aggregate is also being studied. It affects the strength less than shale, but more than 3% leaves holes in the pavement, after one or two years, that give it a speckled appearance.

The Iowa department has made a number of tests on the use of hydrated lime and portland cement in treating subgrade soils. It has been determined that the treatment of soils by these substances will not make an earth road that will carry much traffic.

INDIANA

The Indiana department has been making experiments with rock asphalt to which bitumen has been added. Such material has failed hitherto, but the company supplying the asphalt states that it can prevent failure by dehydrating the asphalt just before it is laid. The work will be carried on through 1926.

Laboratory investigations are being made to determine difference in strengths of highway concrete made of the different brands of cement used in Indiana. The work so far has warranted no conclusions.

NEVADA

Nevada is testing pumice for use as aggregate in the place of crushed stone or gravel, since this material is abundant in the state. Results showed that pumice concrete weighed about 70% of the weight of other concrete and had about 70% the strength.

Bentonite, a mineral used as a filler and for de-inking paper, is being tried out as an asphalt filler. Results showed that additions up to 7% were beneficial.

The state has determined the best grading for gravel used in surfacing roads to be: All material passing a 1-in. screen and 20% to 30% passing a ⅛-in. screen. In making this it is required that all material taken from the deposit not passing a ¾-in. round hole shall be crushed. Special attention has to be paid to gravel surfacing on account of the dry climate.

MICHIGAN

The Michigan highway department has been making laboratory studies on the effect of soft stone in concrete.

A technical study that will be of interest to the entire cement industry has to do with variations in the cross section of briquettes for testing. The difference between tests made with a standard portland cement and a non-standard cement are also being studied.

NEW JERSEY

Comparative Tests on Stone and Gravel

The investigation being carried on by the New Jersey Highway Department in connection with the Bureau of Public Roads is of interest to the entire aggregate industry, since it includes tests to determine almost every variation due to the aggregate in concrete. Both compressive strength and modulus of rupture will be determined from 13 gradations of each type of coarse aggregate used, and the "yield" for each is to be determined.

It is hoped to determine the relative yield and the relative strength of stone and gravel concrete mixed in the same proportions to the same consistency and with the same size of coarse aggregate.

It is also desired to determine what grading of coarse aggregate and what proportion of fine to coarse will give the greatest yield for concrete of both stone and gravel.

TEXAS

Texas is a large producer of rock asphalt and the highway department is testing different mixtures with reference to the wide variation in climatic conditions found in the state.

A type of road, called the "invisible track highway," with concrete or brick tracks separated by asphalt or macadam, is being tried out.

GEORGIA

The laboratory of the Georgia highway department is engaged in a study of the use of high-alumina cement to test aggregates to be used in standard portland cement concrete. It is hoped by the use of this material to cut down the time required for testing to 48 hr.

MISSOURI

Missouri has made field trials on the use of diatomaceous silica as an admixture in concrete and as a result it has opened the specification to the use of certain approved admixtures.

TENNESSEE

The Tennessee department has been studying the proportioning of concrete by weight and by volume, and it finds many advantages in favor of proportioning by weight. In addition to avoiding the errors caused by the bulking of sand, it finds that excessive moisture in the mix is avoided and also that the solid volume of the mix may be absolutely determined.

The study of the strength of concrete made with aggregates of known voids has been begun. Mixes were made with marbles of the same size and of different sizes, making four mixes with different percentages of voids. It appeared that strength was a function of void size rather than of the number of voids.

A two-year test is going on to find the best cement for certain grades of sand. The testing divison has analyzed all the Tennessee sands and obtained their strength ratios to determine whether or not the fineness modulus gives an indication of the strength ratio. Another study of importance is that made of the use of fine local sands with added cement to make up for certain deficiences found in these sands. A chart has been prepared showing the amount of added cement needed with certain east Tennessee sands.

VERMONT

The Vermont laboratory has been studying the use of Lumnite cement in testing concrete sands, with the idea of using it for accelerated tests, standard Ottawa sand being used for comparison.

Results show the 7-day portland ratio is higher than the Lumnite ratio over the 28-day period; the 24-hr. sample with Lumnite runs consistently lower than the 7-day portland, an effect ascribed to the retarding effect of local sands; the Lumnite ratios over 3 days, 7 days and 28 days are practically constant, and the 7- and 28-day tests with Lumnite may be omitted. The 3-day Lumnite test gives comparable results to the 7-day portland, about equal for sands 125% of Ottawa in 7-day portland tests, and 10% to 20% lower for sands over 125% Ottawa.

WISCONSIN

The Wisconsin laboratory is testing the relative strength of concrete made with gravel graded from 2-in. to ¼-in. and gravel containing excessive amounts of pea gravel. Tests will be complete in November.

Pack house, at left, and one of the two rows of silos, of the new packing and storage plant of the Laurence Portland Cement Co., Siegfried, Penn.

Latest Methods of Handling Cement Used at New Lawrence Pack House

Lawrence Portland Cement Co., Siegfried, Penn., Pumps Cement Pneumatically to Silos and Packing Bins

PACKING facilities have become an increasingly important part of the portland cement business. The great increase in production, something like 100% in the last decade for the entire industry, has called for better methods of storing and handling than were thought of years ago. Inventors have responded to the demand for better pack house equipment with new systems of transporting cement, better forms of storage houses, better handling methods for sacks and the sacked product and efficient dust collection systems that render the pack house quite as comfortable to work in as any other part of the plant.

All these may be seen in their most modern form at the new pack house of the Lawrence Portland Cement Co. at Siegfried, Penn. The Lawrence company is not only one of the oldest cement manufacturing enterprises in the Lehigh Valley, it is one of the oldest in America. Siegfried was the place where cement rock was discovered in Pennsylvania and the discovery was very promptly utilized by building a plant to avoid the cost of bringing cement from New York state to use on the Lehigh coal and navigation canal. This was in 1850. The Lawrence Portland Cement Co. makes "Hy-Test" mason's cement from this rock (although by far the greater part of its production is portland cement) and handles it through this most modern of pack houses.

The portland cement made at this plant is

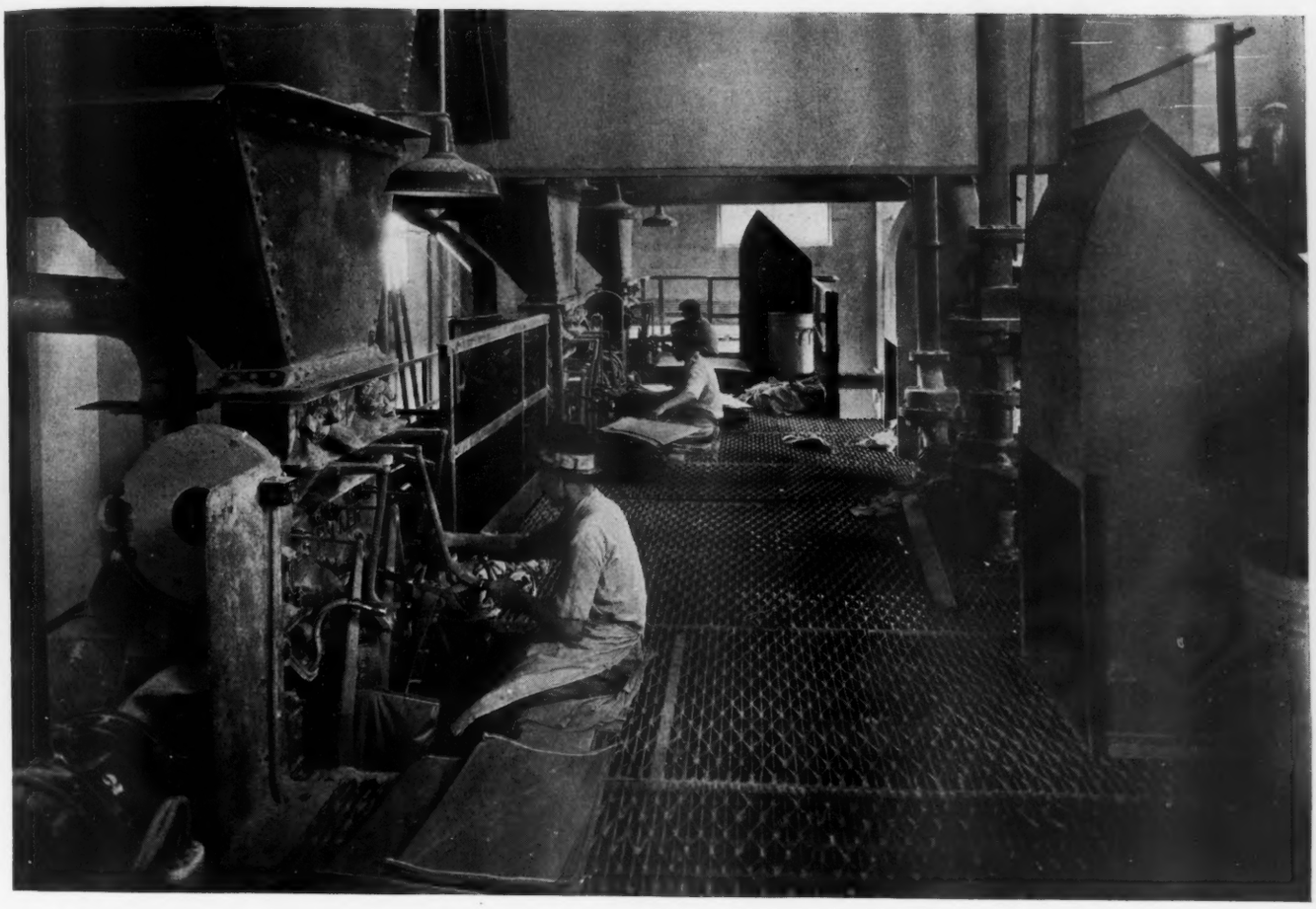
Screw conveyor under silos and chutes from silos

the well known "Dragon" brand which has been bought by three generations of cement users. But if the brand is old the plant may be called new; for just as fast as invention and discovery have set new standards in the cement industry the plant has changed to keep pace with them. It is not surprising to find the newest sort of packing house and equipment in a plant like this, as it is only in line with the policy of the company to keep fully abreast or a little ahead of the progress of the industry.

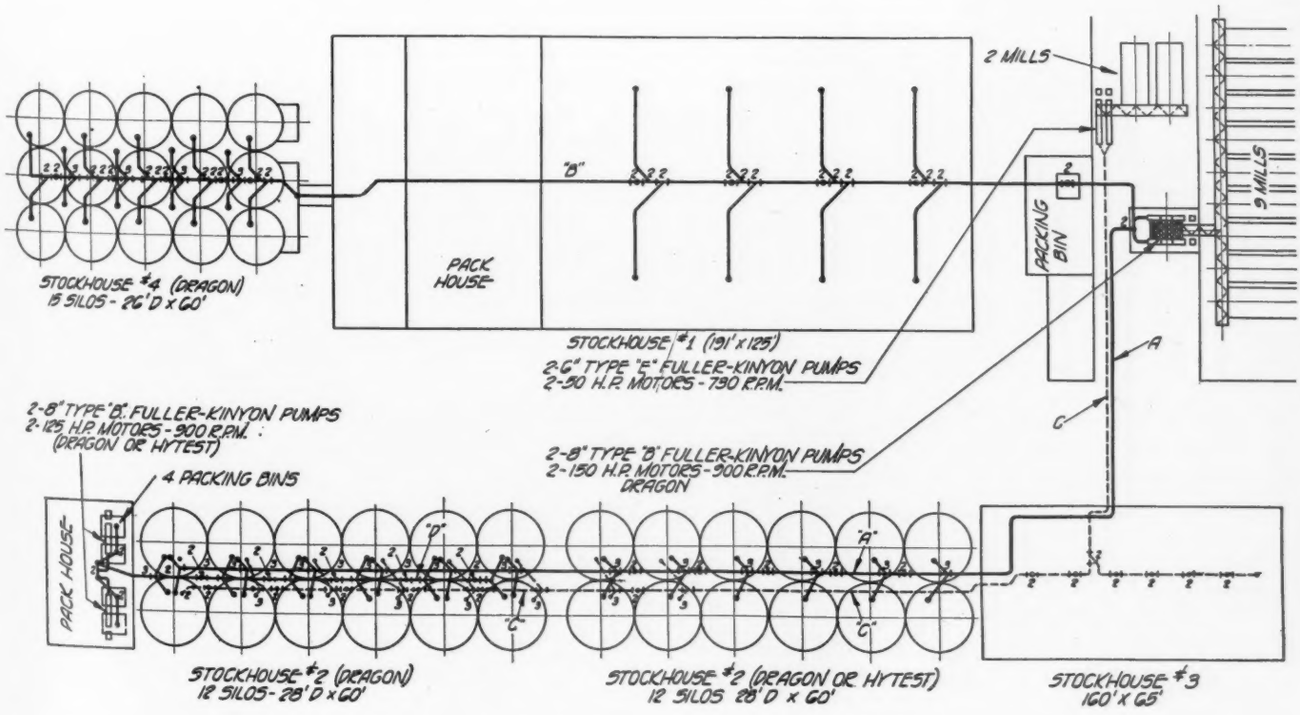
Older Pack House Also Modernized

There are two pack houses at the Lawrence plant. The older has been modernized and brought up to date by the addition of modern transporting and handling equipment. This older plant has a long building of 191x125 ft. now given entirely to storing and handling "Dragon" cement. Beyond this are the concrete silos, three rows with five in each row, also used for storing portland cement.

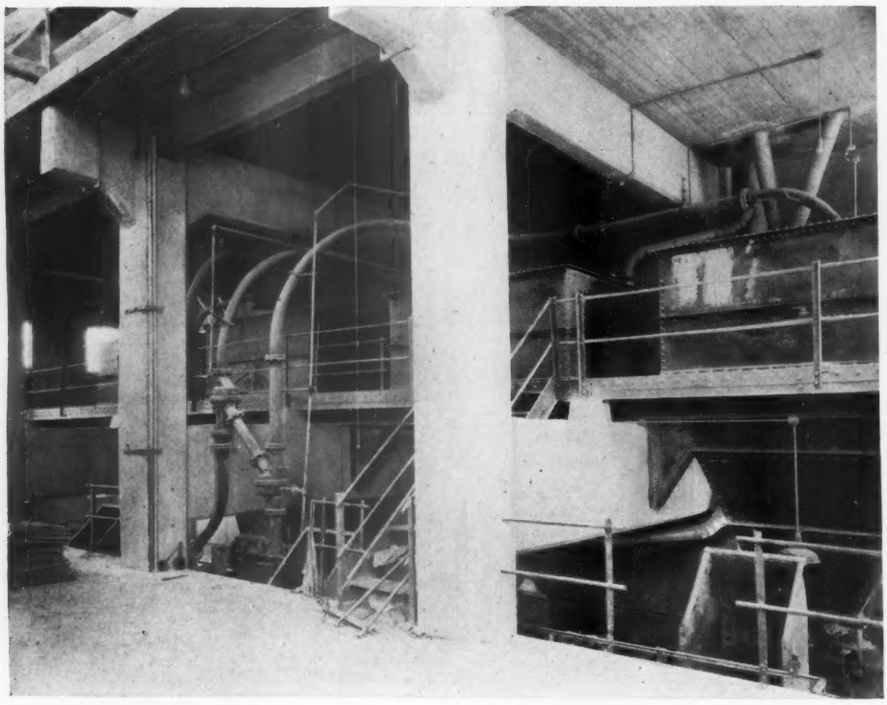
The newer plant is for both portland and "Hy-Test" cement and it has a greater storage capacity than the older. There are two sets of concrete silos each of which is 28 ft. in diameter and 60 ft. high. They are set about 2 ft. apart at the nearest point and narrow walls have been built be-



This clear picture shows how free the air is from dust in the pack house. The curved front boxes are sack containers not yet in place



Plan of both packing and storage plants showing pump lines for cement. The letters designating lines identify them in the text



Bins for cement above valve-bag packers and piping for filling them with cement

tween, making interstitial bins of the spaces between the silos. The silos, 24 in all, are in two rows and under each is a 16-in. standard screw conveyor.

Pumping System Used Throughout

In both the old and the new packing plants the system of transporting and handling the cement is the same. Fuller-Kinyon pumps take the cement from the finish grinding mills and pump it to either the storage house or the silos. Screw conveyors underneath the silos take it to the pack house. In the newer plant Fuller-Kinyon pumps are also used to fill the packing bins and to transfer cement from one silo to another whenever this is necessary. The two systems of pumping are so interconnected that either cannot be described by itself but the following description is mainly concerned with the newer plant.

There are seven openings in the bottom of each silo in the newer plant and each of these openings is fitted with a horizontal slide which It may be set to any opening. The slides are worked by pulling a chain which passes over a sprocket that turns a pinion engaging a rack on the slide. A new type of chain has been developed for this use—one that will not kink or break in service. Inside of the silo near each slide is a pipe for compressed air. If the cement arches so that it will not flow out freely, a little compressed air blown into the silo will break the arch and start the cement to running.

The spouts which lead from the slides to the screw conveyor lead into the side of the conveyor as will be noted from the illustration. The spouts are more difficult to make in this way, but they allow free access to the conveyor at all times. This was found to be of importance from building the spouts the other way in the older pack house. The covers over the conveyor are tightly clamped to prevent dust escaping and a new form of bar clamp has just been devised. that holds the cover tight and yet allows it to be raised quickly whenever this is needed.

These conveyors have ordinary cast iron flights placed on a pipe shaft and fitted with plain gudgeons. Each is driven by a 75-hp. Westinghouse type C. S. induction motor through a Palmer-Bee speed reducer.

The screw conveyors discharge into steel boxes, below which is a short cross conveyor of the same type. These conveyors discharge to the 8-in. Fuller-Kinyon pumps that transport the cement to the hoppers above the sacking machines.

Cement Behaves Like Liquid

The Fuller-Kinyon pump, although it is a comparatively new machine, has almost revolutionized the handling of cement, powdered coal and other finely divided materials. It takes advantage of the fact that such materials when mixed with air, so that the particles are separated by films of air, form a mixture which behaves like a liquid. Such a mixture will flow in a pipe or a chute with very little friction, so it can be pumped as water is pumped. The inventor got the idea of utilizing this liquid effect of air and finely divided solids from the "flooding" of screw conveyors, something that occurs when air becomes mixed with cement or pulverized coal. It is one of the many examples of how inventive skill has turned a characteristic that was a disadvantage and a nuisance to an advantage and a benefit. The pump was described in the 1925 Annual Review number of Rock Products in an article by its inventor, Alonzo G. Kinyon. Eight of these pumps are in use at the Lawrence plant.

The discharge of the pumps passes through ordinary pipes and the only difference noted between the pipe system and that which would be used for water is that the bends are made with a long radius, as they are in the better installations for water pumping, for that matter. Flanged unions are used for making connections and the valves are of a simple gate type devised for the purpose. The system includes an auxiliary blowout line, and at regular intervals this auxiliary is tapped into the main line through blowout flanges and through valves to povide for emergency blowouts when occasion demands, though such emergencies seldom occur in such a system. Even if the

Pipes and valves in the gallery above silos

cement should separate from the air and settle in the bottom of the pipe, the flow of material from the pump itself, or direct blowing from the pump, will almost always take it up and carry it along.

Amount of Cement in Bins Told Automatically

An ingenious arrangement in connection with these pumps allows the condition of the packer bins to be told at a glance. A board has a number of electric lights on it, each light representing a bin. The light remains white and steady until the bin is nearly filled and then it begins to flicker. The light shows red for a full bin and white for an empty bin.

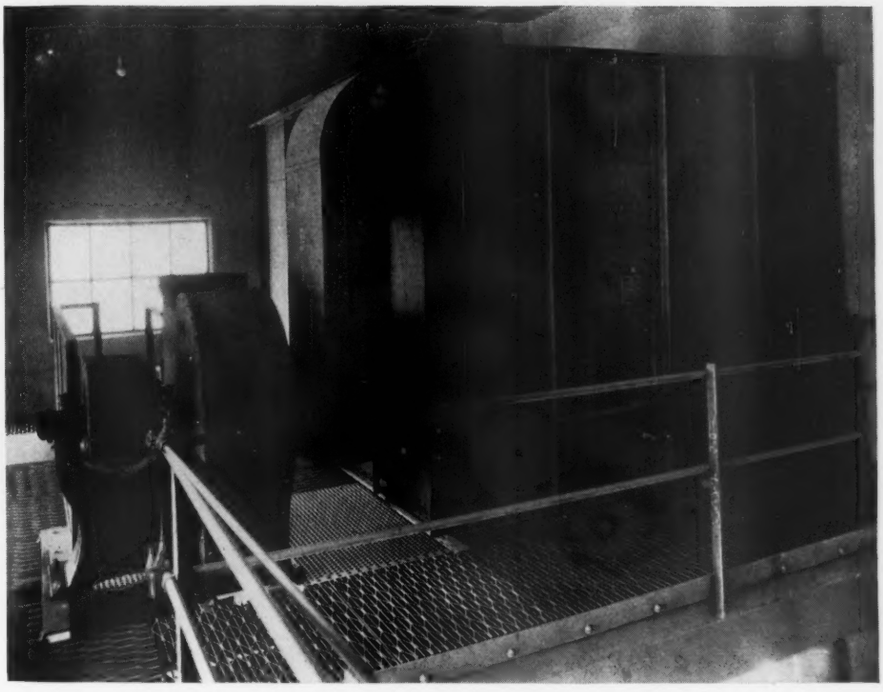
The pumps are arranged so that some are interchangeable with others in their work and the piping is laid out in four distinct systems.

The system marked A in the drawing is used by either of two 8-in. pumps which sends the freshly ground cement to the silos of the new packing plant. This line is 603 ft. long, including a rise of 82 ft., and there are eight two-way and 11 three-way valves connecting to the line. The pumping rate is 425 bbl. per hr.

System B takes cement from the same pumps to the big stock house and silos of the older plant. The total length is 660 ft., including a rise of 85 ft., and there are 28 two-way and four three-way valves on the line. The pumping rate is 425 bbl. per hr.

In order to pump through these long lines each 8-in. pump is powered with a 150-hp. motor running at 900 r.p.m.

System C is connected with the 6-in. pumps and used to fill the silos in the new packing plant. The longest pumping distance is 686 ft., including a rise of 68 ft. There are 14 two-way and seven three-way valves on the line. The pumping rate is much less than that of the 8-in. pumps, being 75 bbl. per hr. and a 50-hp. motor running at 730 r.p.m. is sufficient to do all of the work.



The dust collecting system with fan and direct connected motor at left

System D receives the cement from the screw conveyors in the new pack house and pumps it to the packing bins. The longest distance pumped is 284 ft., including a rise of 91 ft. and there are 15 two-way and five three-way valves on the line. Each of the 8-in. pumps supplying this line has a 125-hp. motor running at 900 r.p.m. The pumping rate is 300 bbl. per hour from each pump.

All the above motors are induction motors of Westinghouse make.

Two Air Compressors

The compressed air which is necessary to mix with the cement to bring it to a pumping mixture, and also to use in other places, is supplied by two Pennsylvania compressors, type 3A, with 12x18-in. cylinders running at 175 r.p.m. and capable of delivering air at 100 lb. pressure. Each is connected to a Westinghouse 75-hp. type C. S. motor through a leather belt and Lenix drive.

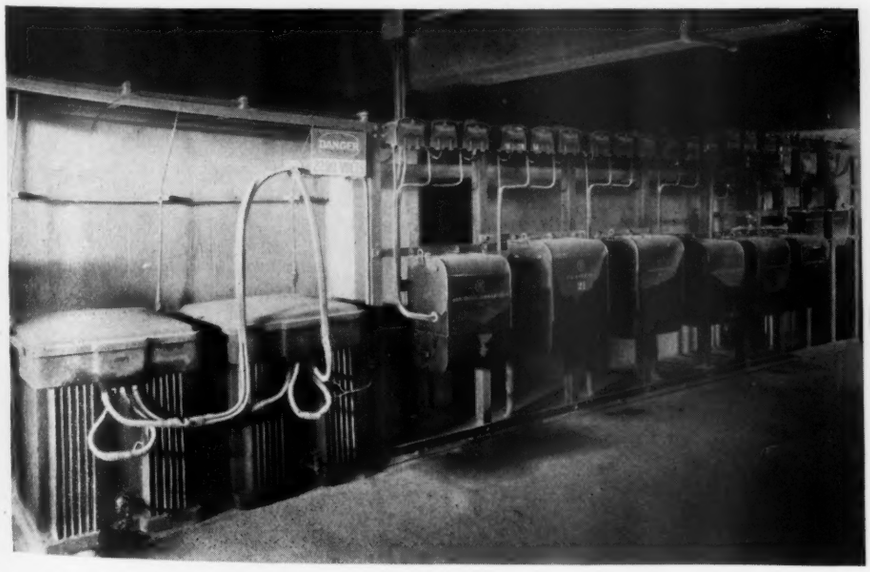
The cement from the packing bins is fed to three Bates valve-bag packers of the type which is now of almost universal use in American cement plants. When the plant was visited all of these were packing cement in the Bates multi-wall paper bags. But it was said that cloth sacks are still used to pack a large part of the production.

Behind the men working at the Bates machines in the photo may be seen some curious metal boxes with curved fronts. These are gravity feed boxes for holding sacks. The sacks are fed into the top and are pulled out as desired from the opening at the bottom by the man at the machine. A man can keep all three sack reservoirs filled as a small part of his duties so that the man at the machine will always find sacks at his hand as they are needed. The installation of these sack feeders was not complete when the picture was taken, and the feeders are not shown in their final positions.

The filled sacks go by belt conveyors direct to the cars or trucks. Bulk cement may be loaded into cars directly through a pipe which connects to one of the packing bins.

No Dust in Storage and Packing Plant

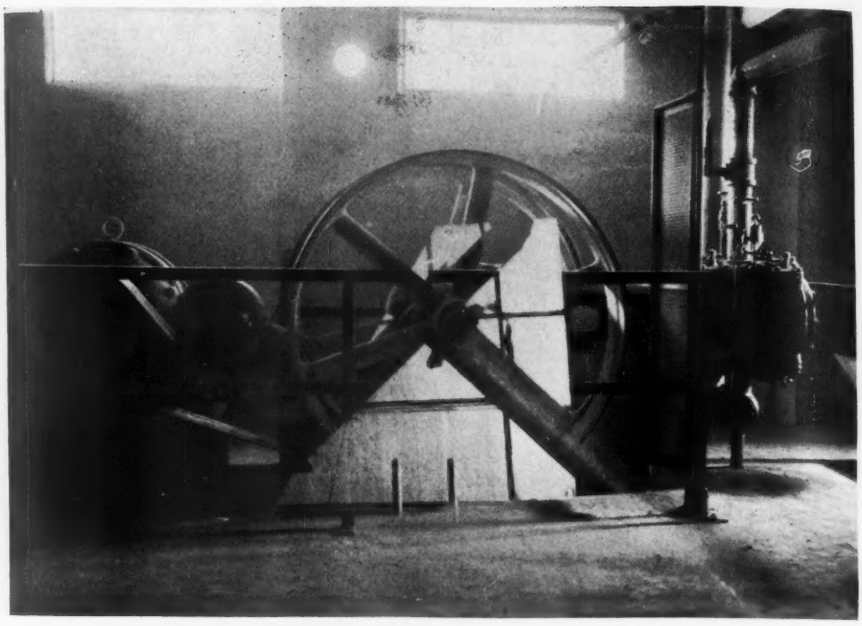
The air is clean and free from dust throughout the whole of the new storage and packing plant. Every part of the plant where dust would be likely to rise is connected with the dust collecting system. This includes two J. W. Paxson dust collectors which are served through a Sturtevant fan direct-connected to a 15-hp. Westinghouse in-



Transformers and starting boxes for plant motors

duction motor. The principle by which this dust collector operates is that of filtering the dust laden air through cloth. Whenever the cloth becomes obstructed by an accumulation of dust the current is reversed for a short time and the accumulated dust falls as a mass or clot from the cloth and goes back to the packing bin. This collector and the installation at the Lawrence plant were also described in the 1925 Annual Review number of Rock Products. The system is certainly efficient. While the notes for this article were being taken the packing plant was in operation and the air everywhere was practically dust free. The pictures made at the time show this conclusively.

The main office of the Lawrence Portland Cement Co. is at Siegfried, Penn. Frank H. Smith is president; Marion S. Ackerman, vice president; Charles A. Porter, third vice president and superintendent; James S. Van Middlesworth, secretary; Edgar E. Sheppard, treasurer; C. M. Loeser, assistant treasurer, and Lewis A. Eisenhard, chemist. The company's selling agents, the Lawrence Cement Co., has sales offices at 302 Broadway, New York; in the Harrison Bldg., Philadelphia, and at 31 Milk St., Boston.

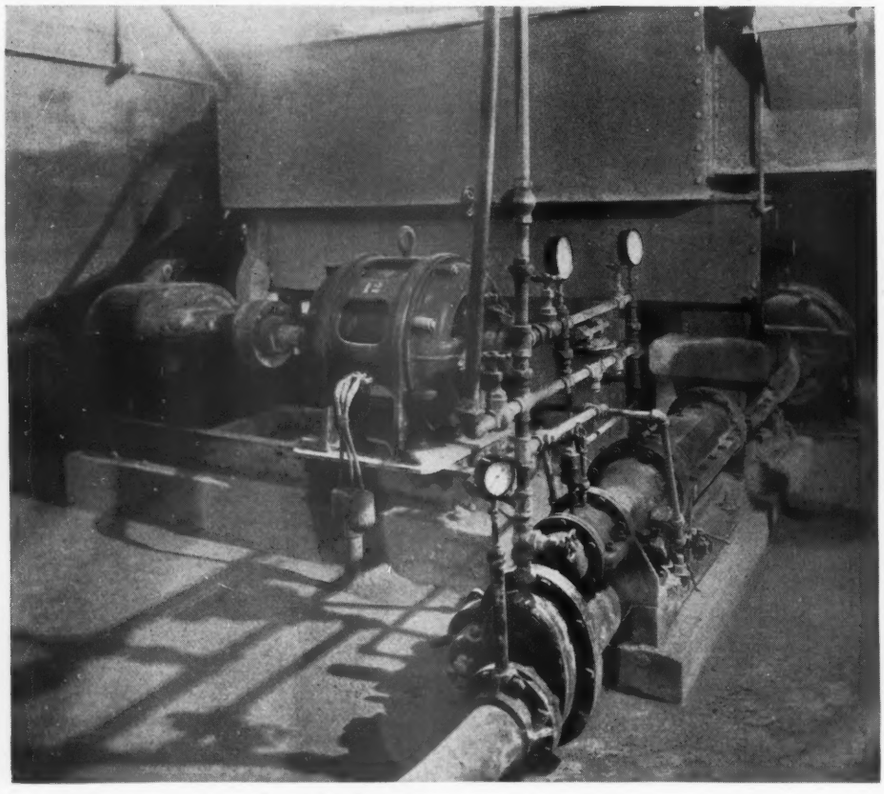


One of the two air compressors with short-center belt drive which furnishes the air needed for pumping cement

The French Cement Industry

THE following account of the state of the cement industry of France is from a "Report on the Economic and Industrial Conditions in France," issued by the British Department of Overseas Trade and printed in the English paper, *Roads and Road Construction:*

"The French cement industry, which formerly had a considerable export trade, has its principal centers in the Grenoble, Le Teil (Ardeche) and Boulogne districts. In 1924 it increased its output, and although from an export point of view its pre-war position has not been regained, yet for the first time since 1913 a favorable export balance of 4500 tons resulted in 1924. The heavy demands made in connection with reconstruction work after the war resulted in imports exceeding exports for the years 1919-1923, and French manufacturers in order to supply the home market were forced to forsake their foreign markets. Reconstruction work having practically ceased, since the middle of 1924, the industry has been able to make a real attempt to recapture its lost foreign markets. Manufacturers continue to increase productive capacity (in the Pas-de-Calais area, the 1922 capacity of 352,000 tons is being increased to 1,500,000 tons), and while the 1923 output of 5,900,000 tons was exceeded during 1924, it is anticipated that by the end of 1925 French output will show a further marked advance. One concern is producing over 1,000,000 tons a year, another about 400,000 tons."



One of the two pneumatic pumps and drives for screw conveyor under silos in new pack house. Eight of these pumps are in use at this plant

Principal Works Described

The three principal cement enterprises are described. The largest is the *Establissments Poliet et Chausson* with 30,000,000 francs capital and a bond issue of 20,000,000. It has 28 works engaged in the production of cement, lime, plaster and bricks. It specializes on a rapid hardening cement which is being made at its Gargenville works with an annual capacity of 240,000 tons.

The *Societe Anonyme des Ciments Francais et des Portland de Boulogne-Sur-Mer*, with a capitalization of 10,000,000 francs, producing 100,000 tons of cement annually, has purchased other cement manufacturing companies and expanded by buying lands and quarries. It has acquired important bauxite resources as a material for making high alumina cement.

The *Society Anonyme des Chaux et Ciments de Laforge et du Teil* is the well known maker of *Ciment Fondu* (a high alumina cement). It has six factories in France and one in Algeria. Its capital is 18,300,000 francs.

Making 3-Day Concrete from Standard Portland Cement

TWO important highway jobs in and near Chicago have demonstrated new possibilities in portland cement concrete. In both cases a compression strength of 2300 lb. was obtained in three days when the pavement was ready for traffic. The saving to the public in time amounted to 18 days, since 21 days is the usual time required to harden concrete sufficiently for it to withstand travel.

One of these jobs was on Ogden avenue near La Grange, Ill., where grades at through street intersections had to be changed. The density of traffic at times is 1000 vehicles an hour at these intersections. The other was at Grand avenue and Dearborn street in Chicago and included an alley and pavement on two sides of the new building of the Portland Cement Association. Traffic is very dense at this point and much of it is of large trucks heavily loaded.

The work on the La Grange job was done by the Standard Paving Co. of Chicago following instructions given by the Universal Portland Cement Co. The Chicago job was done by the Marquette Construction Co., but the method was worked out in the laboratory of the Portland Cement Association.

In both cases the factors for making this early high strength concrete were the same. They were: (1) Decreasing the amount of mixing water, (2) Increasing the mixing time, (3) Using a little more cement, and (4) Keeping the pavement damp until it was used.

The additional cement and the lengthened mixing time are the only factors that would increase the cost of the work. The extra cement in the La Grange job amounted to ½ bbl. per cubic yard, 2.2 bbl. being used instead of the usual 1.7 bbl. In percentage this is 29%. In the Chicago job the mix was 1 part cement to 3.7 parts aggregate (21.2% cement) as against the usual highway mix of 1-1½-3, for example, which contains 18.2% cement. The added cement in this case was therefore 11.7%. The mixing time on the La Grange job was 2 min. and on the Chicago job 1½ min.

The Universal Portland Cement Co. has issued a pamphlet in which it sets forth the method of making early high strength concrete from Universal portland cement. It was by following the methods described in the pamphlet that the Standard Paving Co. achieved such a success, and in a letter to the Universal Co. the Standard Co. states that it saved $300 on 36 yd. of concrete by following the instructions in the pamphlet. The contractor describes the method as follows:

We met the need for opening the street intersections quickly by using methods that produced a pavement that showed at three days a strength of 2364 lb.—practically the same strength developed at 28 days by ordinary methods. We finished placing the concrete late Tuesday afternoon and by Friday night it was ready for traffic. Even during that brief time traffic was only partly disturbed, as one-half of the intersection was left intact while the other half was being placed. An inspection made Monday (after the pavement had been in use three days) revealed that it was in first-class condition, notwithstanding the extremely heavy week-end traffic of at least 25,000 trucks and pleasure vehicles that had passed over it.

When five hours old the pavement had sufficient strength to permit walking over the surface without marring it. We commenced sprinkling it when it was six hours old and kept it wet for three days. Tests

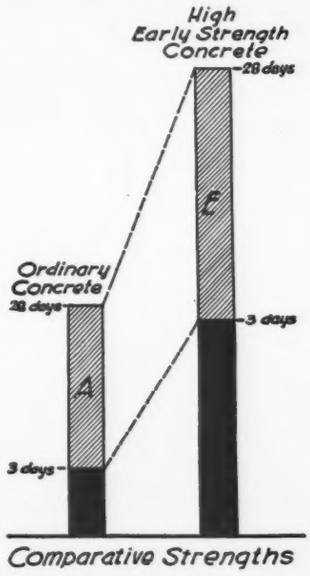


Diagram used in advertising high early strength concrete

made on the job by the Robert W. Hunt Co., engineers, of concrete as used here showed a compressive strength per square inch at three days of 2364 lb.; at seven days, of 3600 lb., and at 28 days a strength of 4258 lb. These results, secured under field conditions, conform substantially with those obtained in laboratory tests for the mix and consistency of concrete used.

We used a 1:1½:2½ mix with between 4½ and 5 gal. of water per sack of cement, a good grade of sand and crushed limestone up to about 2 in. in size. We set hoppers on Barber-Greene loaders for 7½ ft. of sand and 12½ ft. of crushed stone, the amount of material required for a 5-sack batch. (It should be noted that the volume of water includes the moisture in the sand and stone as used.)

The concrete was mixed 2 minutes. A little longer mixing time insures thorough mixing, allows everyone adequate time to do his work, reduces idle time of the mixer and requires fewer men and trucks for handling the material. Increasing the mixing time, therefore, to 2 minutes does not *proportionately* increase costs and decrease output compared with 1-minute mixing time.

The description of the work at Dearborn Street and Grand Avenue, Chicago, taken from the *Concrete Highway Magazine*, published by the Portland Cement Association, follows:

To meet the needs of this particular job, a mix was designed in the Portland Cement Association laboratory which could be opened to traffic in 3 days. The proportions were 1 part cement, 1.6 parts sand, 2.1 parts coarse aggregate and 5 gal. of water per sack of cement. No admixtures or accelerators were used. Ordinary paving materials in the contractor's storage yard were used, consisting of a well graded coarse sand, pebbles ranging from ¼ in. to 2 in. in size, and crushed granite ranging from ½ in. to 1½ in. in size. Standard portland cement from the contractor's stock was used.

Each batch was mixed 1½ min. after all ingredients were in the mixer drum. The rich mixture proved very readily workable considering the limited amount of mixing water. It stiffened up quite rapidly and the finishers found it necessary to work directly back of the mixer.

The pavement was sprinkled as soon as it was possible to do so without marring the surface. This was kept up at intervals during the first three days. It was intended to open the pavement to traffic in three days, but delay in repairing the edge of the adjacent old asphalt pavement kept it closed until the morning of the fourth day after completion. The alley, however, was opened to traffic at the end of the third day.

Several 6x12-in. test cylinders were taken from the concrete after dumping and stored while hardening on the roof of the Association building. The average compressive strengths of these cylinders were as follows:

At 30	hours	1330 lb. per sq. in.
At 2	days	1860 lb. per sq. in.
At 3	days	2350 lb. per sq. in.
At 7	days	3100 lb. per sq. in.
At 28	days	4720 lb. per sq. in.

Through the courtesy and cooperation of the Chicago Board of Local Improvements, J. J. Sloan, president, and the Bureau of Streets, this work was done by private contract.

The credit for early high strength concrete must be largely given to the Universal Portland Cement Co., who have "sold" the idea to the engineers and contractors of the country by the excellent advertisements they have published in the leading industrial papers of the country. One of the most striking advertisements is reproduced here.

Dewey Portland Places Additional Contracts

CONTRACTS totaling nearly $500,000 for material and equipment to be used at the new Dewey Portland Cement Co.'s plant now building at Davenport, Iowa, were recently placed by that company. The largest order, of $300,000, was to the McClintock-Marshall Co., Chicago, for structural steel, etc. Other awards were to the Falk Corp., Milwaukee, $12,000 for gear reducers; Priester Construction Co., Davenport, water tanks, $7500; Fairbanks-Morse Co., Chicago, $22,000 for electric motors; Worthington Pump Corp., New York, $4500 for pumps; the Elliot Co., New York, $17,000 for condensers; Griscombe Russell Co., New York, $17,000 for evaporators; Continental Tile Co., Chicago, $25,000 for roofing tile.

Modern Methods and Processes of Mining and Refining Gypsum*

Part X.—Structural Gypsum Products—Dome Tile and Roof Tile

By Alva Warren Tyler

MANY products other than wall plasters have been manufactured from calcined gypsum since the earliest time. Such products as ornamental and novelty casts, pottery molds, wall moldings, etc., are seldom if ever produced by the gypsum manufacturers, and will not be considered here.

The use of gypsum for structural purposes, however, has been developed within the past 20 to 25 years by the gypsum manufacturers themselves, and includes gypsum partition tile, filler or dome tile, roof tile, and plaster board and wall board.

The development of any commodity of this nature is necessarily based on characteristics of fundamental importance in the field to which it applies. These characteristics as applied to structural gypsum products are as follows:

1. High fireproofing qualities.
2. Low heat conductivity.
3. Low coefficient of expansion.
4. Light weight.
5. Ease of application.
6. Ease of after treatment.
7. Low cost.

Fig. 1—One type of gypsum roof tile

The high fireproofing qualities of rehydrated calcined gypsum are well known today and are due not only to the noncombustible nature of the material but to its low heat conductivity. This latter quality remains effective even after the gypsum is subjected to temperatures above the calcining point. For instance, if a gypsum wall is subjected to excessive heat, as in the case of fire, until calcination begins, the opposite side of the wall cannot reach above the temperature of the freely liberated steam until the wall has become completely calcined all the way through. Furthermore, the transfer of heat is still further retarded by the continually increasing thickness of anhydrous gypsum as calcination proceeds. The very low coefficient of expansion also aids the fireproofing qualities of gypsum, as this characteristic prevents cracking and spalling under high temperatures, thus maintaining under the most severe conditions an effective barrier against the progress of fire. Authoritative tests carried out over a period of many years have shown that the cast gypsum used for interior partition construction and steel protection carries the highest fire protection value of any structural material of equal thickness used for a similar purpose. In fact, it is the only material that has passed the required test and received the approval of the Underwriters Laboratories for nonbearing partitions and stairway and elevator enclosures in fireproof buildings.†

Has Advantage of Light Weight

The light weight of gypsum cast in hollow tile form gives it a further advantage for use in partition construction, since it not only greatly reduces the load on the foundations and supporting steel work, thus making appreciable savings in these details, but it also makes possible the casting of units having a larger wall area, thereby increasing the rate at which a given wall may be laid. Gypsum partition tile are from 35% to 50% lighter per square foot than other tile of equal thickness designed to be used for a similar purpose. The light weight, furthermore, makes for ease in handling, and this feature, combined with the fact that the

*Copyright, 1926, by Alva Warren Tyler.

†All test records and specifications on structural gypsum products may be had by application to the Gypsum Industries, 844 Rush street, Chicago, Ill.

material may be as readily sawed as soft lumber, gives a product highly desirable to the trade.

The ease of after treatment of gypsum tile lends economy in both labor and material. The tile, being cast in uniform molds, are of equal thickness and have parallel faces, making true walls requiring less plaster than any other type of construction except gypsum plaster board. Gypsum plaster spreads easily over the tile and there is practically no waste.

The low cost of structural gypsum products is the result of systematic development together with an ever-growing demand which has necessitated quantity production and consequently improving of methods and higher efficiency in production. And even though there were no advantage in first cost of these products over other materials for a similar purpose, it is evident from the advantages cited in items 4, 5 and 6, above, that the total finished-in-place costs will be less than those for other materials—to say nothing of the greater fireproofing qualities of the gypsum products.

Gypsum tile at the present time may be divided into three classes:

1. Filler or dome tile.
2. Roof tile.
3. Partition tile.

Fig. 2—Showing ease of laying roof tile

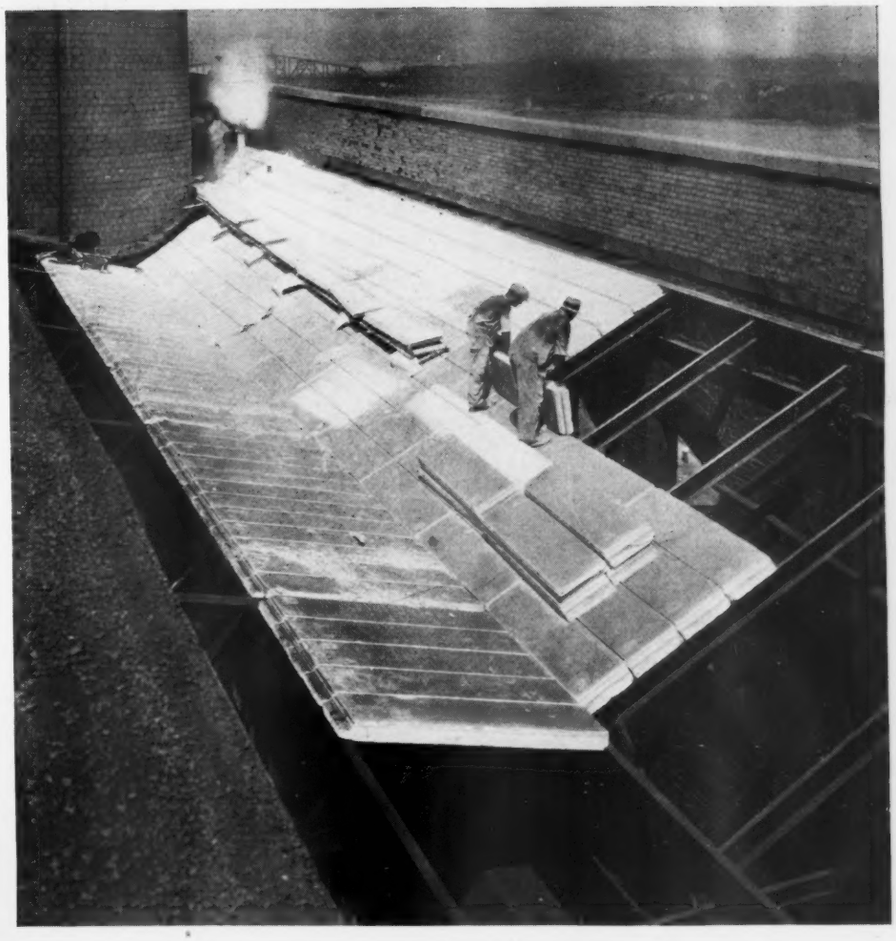


Fig. 4—Gypsum channel roof tile

Inasmuch as the application and method of manufacture of each of these products if of individual character, they will be considered separately.

Dome Tile

Filler or dome tile were designed to fill the voids between floor beams in fireproof construction. Their use serves a triple purpose: (a) They fill the voids; (b) in poured concrete beam construction they serve as forms, eliminating a large part of the form work; (c) they form the ceiling for the floor below, leveling out from the lower face of the beams, thus eliminating the necessity, in many cases, for suspended ceilings.

Gypsum filler tile are usually made from extra dense mixtures, second settle stucco being preferable to give additional strength. Still greater strength may be had by subjecting the tile during its setting period to considerable pressure. Fig. 3 illustrates filler tile as they are usually made, and Fig. 5 shows the method of application. It will be noted that at the point where the floor beams intersect the main girders the tile must have closed ends to prevent the concrete from running into the core spaces when being poured. The intermediate tile may have cores running all the way through, although the tile are stronger and an extra set of molds may be eliminated by casting all tile with one closed end.

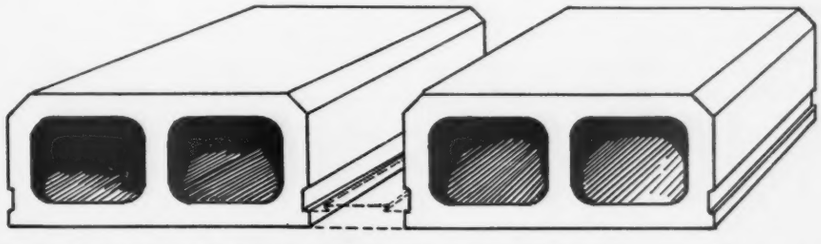


Fig. 3—Filler or dome tile of gypsum, the dotted lines between indicating a pre-cast gypsum joist facer

Roof Tile

Roof tile were designed to fulfil very definite purposes other than strictly those of

fireproofing, which of course is fundamental. These purposes are: (a) Due to the very low heat conductivity of gypsum tile, already noted, a building roofed with this material is not sensitive to outside weather conditions, the interior being more easily heated in winter and cool in summer, resulting in fuel economy and comfort; (b) elimination of moisture condensation on the underside of the roof, thus avoiding the objectionable dripping so often experienced with other types of roofs when the outside temperature is appreciably lower than that outside, especially when the inside air is subjected to undue moisture conditions; (c) prevention of corrosion and eventual destruction in buildings where hot gases and fumes, usually destructive to other types of roofs, exist; (d) the provision of an attractive under surface, which, if left in its natural gypsum-white color, materially aids in the proper distribution of light—a decided advantage in shops, power plants, etc.

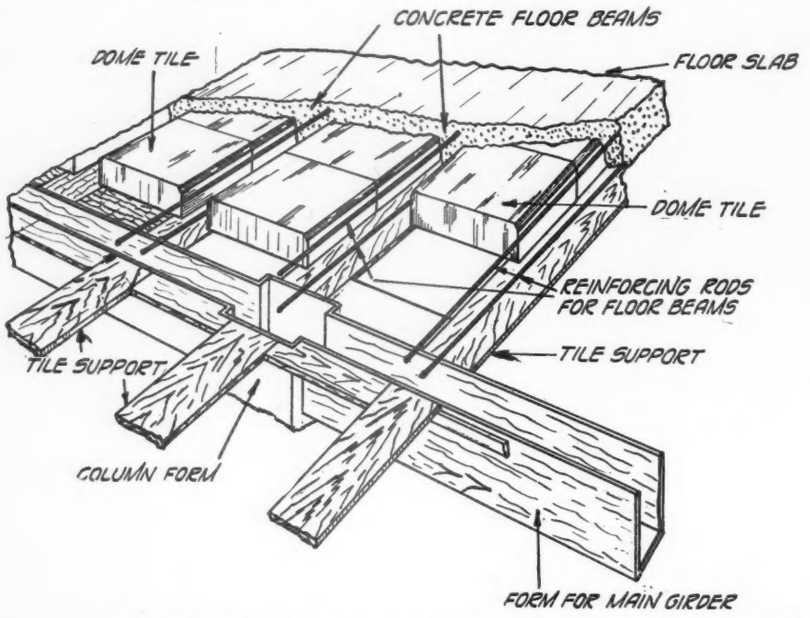


Fig. 5—Method of application of dome tile in reinforced concrete construction

Gypsum roof tile, like filler tile, are preferably made with dense mixtures using second settle stucco and as little water as possible to produce an easily pouring mixture. Considerable structural strength is required, particularly in the long-span tile where standard specifications call for a compressive strength of 1800 lb. per sq. in. ultimate. The sizes of gypsum roof tile vary from 12x30 in. to 18 in. x 8 ft. in face dimensions and from 3 to 6 in. in thickness. The tile having a thickness of 3 in. are of solid section while all other thicknesses are made hollow by coring or have a channel section. This design of course greatly decreases the weight without appreciably decreasing the strength. A special long span tile designed with the suspension principle of reinforcing and of solid cross-section also has a wide distribution.

Practically all gypsum roof tile are reinforced, the reinforcing usually being calculated to give the full strength of the gypsum in compression. When this is the case an electrically welded galvanized steel mat reinforcing is used, this being still further strengthened in the channel sectioned tile by additional reinforcing rods in the channel flanges. When the suspension system of reinforcing is employed the steelwork is designed to carry the total roof load including the dead load of the gypsum slab itself. Figs. 1, 2, 4 and 6 show the various styles of gypsum roofing tile and their method of application. The first three of these photographs are by courtesy of the United States Gypsum Co.

Excepting the small 12x30-in. units, gypsum roof tile are made by hand, that is, in individual moulds set up by hand and into which the reinforcing mesh or rods are placed preparatory to pouring. Power mixers are usually used and the mixed material transferred in buckets by means of a monorail carrier system to the moulds. By properly laying out the moulding room and employing such mechanical equipment as is readily available a very efficient operation may be developed. The small roof tile units are made automatically in machine molds which will be described under partition tile in a later article. Methods of drying will also be deescribed at that time.

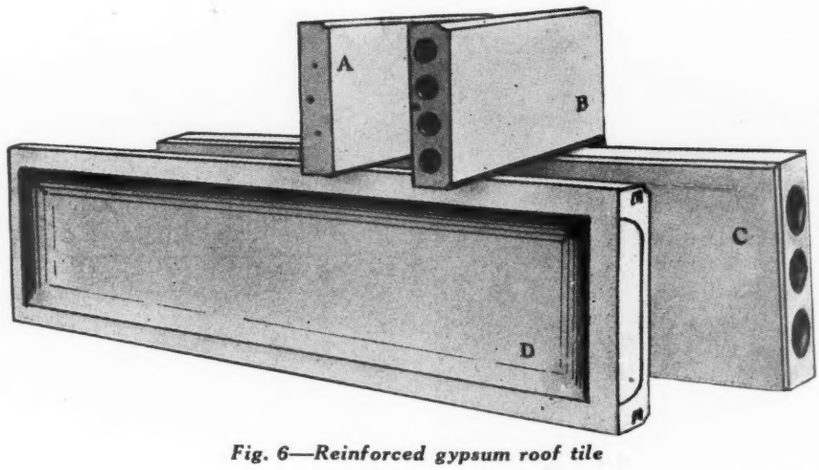


Fig. 6—Reinforced gypsum roof tile

(a) Short span solid (3x12x30 in.); (b) short span hollow (3½x12x30 in.); (c) long span hollow (18 in. wide by 6 to 8 ft. long, 5 to 6 in. thick); (d) long span channel tile (5 to 6 in. thick)

Phosphate Developments in Egypt

THE present concessionaries exploiting the phosphate deposits along the coast of the Red Sea, which are said to be the only ones of commercial importance in Egypt, are the Egyptian Phosphate Co., Ltd., Safaga Bay, Red Sea, and the Societa Egiziana per l'Estrazionne ed il Comercia dei Fosfati of Alexandria. Safaga and El Koseir are the most important centers for the industry, although phosphate deposits have been discovered in many districts of Egypt. Their distance, however, from existing transportation routes has not permitted a wider scale of development.

The English Phosphate Co. is an English firm exploiting deposits at Safaga Bay, which are reported to analyze over 5% calcium phosphate. The mine, which employs about 2500 workmen, transports the phosphate to the coast by means of an electrical railroad, and practically all of the product is exported to Japan. The other exploiting company is Italian, and ships the bulk of the production to Italy. Recently a delegation of technical experts arrived from Italy to investigate the possibilities of even greater expansion of the company's development, to the end that Italian agriculturists may be less dependent upon more distant sources of supply. It has been reported that the Italian government is willing to offer financial assistance to the company, so that modern equipment may be purchased to cut down the overhead.

The entire production of phosphates in Egypt during 1925 was reported as 106,808 metric tons, of which 66,358 tons were exported.—*New York Commercial.*

Minerals Raise Price of Steers

Better Results Secured by Feeding Mixture Containing Ground Limestone

By Cary A. Rowland

Steer at left was given superior finish by a mineral ration. He gained 4% more than his fellow at the right in the same test period, and sold for 35 cents per cwt. more. Minerals added $8.21 to his net sales value

HAVING shown conclusively that a mineral mixture containing ground limestone puts pork on porkers, the Iowa Experiment Station is now giving it a tryout for fattening steers. The results thus far obtained are very promising, and further research is being planned under the able direction of Prof. John M. Evvard, who is recognized as one of the leading authorities on animal nutrition.

Summarizing the results of four different comparisons, the investigators declare that "the feeding of one ounce of simple minerals per two-year-old steer has increased the average margin over and above feed costs $4.75 per steer."

In every one of the four tests, the steers fed "simple" minerals in addition to the usual ration brought a higher price per 100 lb. when sold because of the superior finish. They also made better gains, putting on an average of 25 lb. more flesh per steer.

Several different mineral mixtures were used in these experiments. The simplest contained, ground limestone, 49.97%; bone black, 49.97%; potassiume iodide, 0.06%. To this basic mineral mixture was added in one case an equal amount of sulphur and in another an equal amount of fine sand. Neither of these additions produced satisfactory results.

The minerals were fed mixed with linseed oil meal which was fed at the rate of 2½ lb. daily, divided into two feeds. The steers also received shelled corn, corn silage, and a hay containing an abundance of legumes. Salt was constantly available.

Further experiments must be made before the investigators are willing to go finally on record as recommending the exact mixture to be given, but the above formula represents the best scientific knowledge available at present. It is safe to say that ground limestone will have a prominent place in any revised mixture likely to be recommended in the future.

The ground limestone used in these experiments is described as "high calcium, fairly finely ground." Some of the experiments indicate, however, that a little grit is not objectionable; and a limestone 70% of which would pass a 200-mesh screen would doubtless prove entirely satisfactory.

Limestone Seems to Be Fully Justified as Live Stock Ration

Ground limestone now appears to be fully established as an essential part of almost every livestock ration. Most of the commercial poultry mashes on the market carry 1% calcium carbonate, in spite of the fact that limestone is also fed either in the form of crushed oyster shells or limestone grit.

The standard concentrate ration adopted for dairy cows by the Eastern Feed Conference Board also carries about 1% ground limestone.

Up-to-date feeding rations for fattening hogs include "simple minerals" in which ground limestone plays an important role.

The time seems ripe for the introduction of a mineral mixture for fattening steers similar to that used by the Iowa Experiment station. These materials are all readily obtainable and, with the exception of potassium iodide, are quite inexpensive. Boneblack, it may be explained, is a by-product from the corn syrup refinery.

Now for a glance at the size of the potential market. It is well know that steer feeding operations are conducted chiefly in the Corn Belt states. For practical purposes, the market for a steer-feeding mineral mixture can be regarded as limited to that territory.

It also happens that hog-feeding operations are largely conducted in the same states, often indeed by the same individual farmers. For this reason it would be economical to combine the manufacture of cattle feeding mineral mixtures with the production of similar mixtures intended for hogs. Both products could be distributed through the same channels, thus reducing selling and advertising costs.

The cattle feeding period varies from 120 to 135 days. Each steer would consume at least 120 oz. of the mixture, or about 7.5 lb., during the feeding period.

January 1, 1920, there were in the United States 4,629,000 steers classed as two-year-olds. Of these perhaps 3,000,000 were fitted for market by intensive feeding. On this basis, there is a potential market for steer feeding mixtures of 22,500,000 lb., or 11,250 short tons.

The Iowa Experiment Station figured the cost of the mineral mixture already described at $1.50 per cwt. or $30 per ton. On this basis, there is a potential market for steer feeding mixtures to the value of about $337,500.

While this is not of itself an imposing market, it offers one more outlet for high calcium ground limestone of the finer grade. Producers favorably situated may well consider offering a steer feeding mixture, along with suitable mixtures for hogs and dairy calcium carbonate.

Another interesting comparison, the steer at the right belonging to the mineral-fed group

Washing and screening plant of Indiana Gravel Co.

Excavator History Was Made at Indiana Plant

Operators of Indiana Gravel Company First Used Dragline to Meet Unusual Conditions

THE plant of the Indiana Gravel Co., in Indianapolis, is not the largest in the district, but it is one in which those who have followed the growth and development of the sand and gravel industry in the United States are interested. For it is the plant belonging to Jesse A. Shearer and his associates, and Mr. Shearer is very well known in the industry, not only from his long connection with the National and Indiana associations of producers, but from the part he played in the invention and development of the dragline cableway excavator, which is probably more used than any other one device in the excavation of sand and gravel. The Shearer bucket is that used by Sauerman Bros. with their cableway dragline excavators.

The older of the two plants operated by him today dates back only seven years, but Mr. Shearer began his association with the sand and gravel business in 1897. It was some years after that that the partnership of Shearer and Mayer was formed, and it was really Mayer, according to Mr. Shearer, who invented the cableway dragline. At that time they were operating a small suction dredge, as this was then the only known method of digging sand and gravel economically from below water, the other forms of dredges not having met with much success. The deposits around Indianapolis contain boulders and those boulders were a great obstacle to successful dredging. They accumulated under the dredge, as the finer gravel and the sand were removed, so that the pit bottom gradually became paved with boulders, between which the suction bonnet could not penetrate.

How a Familiar Type of Excavator Originated

The partners worked hard to overcome this difficulty and Mr. Mayer finally devised the dragline bucket as a means of removing the boulders. The first model was not self-dumping. It had to be dragged over a log to induce it to discharge its cargo. Experimenting with different models to change the center of gravity resulted in the present type of bucket. The new type of excavator was quickly copied and patent litigation followed. It was at a time when these suits were being tried that Mr. Mayer decided to sell out his interest in the patent, so Mr. Shearer bought it and kept on alone, achieving the success with which every one in the sand and gravel business is now familiar.

There are two plants on the Indiana Gravel Co.'s ground, both using draglines. The newer, which was built six years ago, is a solidly built structure containing 60,000 board feet of southern pine timbers. The years have no more than seasoned it and Mr. Shearer estimates that it is good for 15 years more of service, which says much for both the material and the construction.

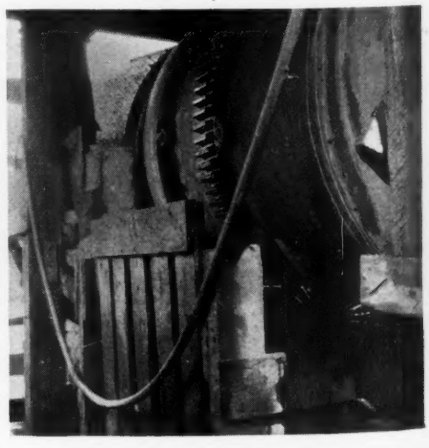
The deposit is near Fall Creek and the water level is only 15 to 20 ft. below the surface of the ground. There is six or eight feet of top soil to be removed but this does not mean that there is a disproportionate amount of stripping to be done as the deposit extends at least 100 ft. below the water level. The bucket was digging sand and gravel from 80 ft. depth at the time of the writer's visit.

Large Tonnage from Small Pond

This depth means a large tonnage from a small acreage. Looking at the pond one finds it hard to believe that a half million tons have been taken from such a small area and that plenty more remains to be removed. A Sauerman steel mast is used for the cableway. The top of the mast is 100 ft. above the ground and the run of the bucket to the far side of the pond is 450 ft. This gives a steep inclination to the main cable when it is slackened to allow the empty bucket to return, which means a very quick return trip and a short time for the cycle of operation.

A deep deposit like this is the ideal condition for a cableway dragline operation. The bucket makes many trips without changing the position of the mast or even changing the path of the bucket. Putting it in another way the dragline is the ideal excavator for such a deposit because there is no other machine that can dig at so great a depth economically and not be bothered by boulders. Some of the boulders encountered are so large that they will hardly go into the bucket.

The bucket is of 1½-yd. capacity and is moved by a Thomas electric hoist. This is a mechanical two speed machine with an in-haul speed of 400 ft. per min.



Combined scrubber and screens

Pond at main plant is 450 ft. across and has produced 500,000 tons of sand and gravel

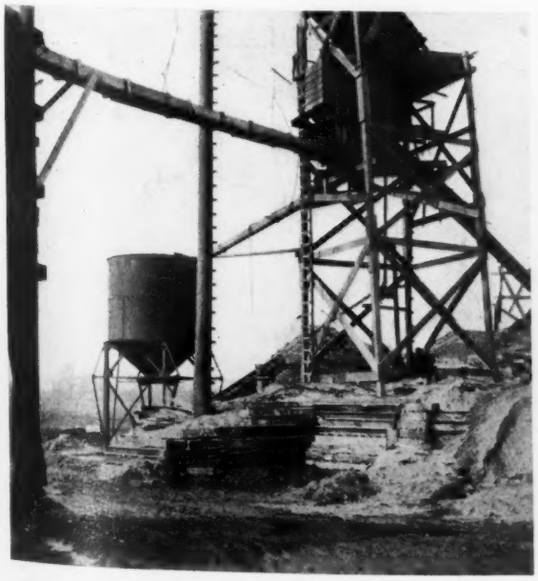
Plant of Lewis Concrete Products Co. on the gravel company's property

The bucket discharges into a steel lined hopper through a grizzly of rails, spaced 6 in. laid flat on the hopper. Below the hopper is a gate which is regulated by a man who watches the feed and the first of the screens. By adjusting the gate a practically continuous feed to the screens is obtained.

The first screen is a gravity screen with 1¼-in. square meshes. It is set with about 45 deg. inclination. The oversize goes to a Universal jaw crusher, except in winter weather, when so much ice accompanies the oversize that the crusher is passed by a chute leading to a stockpile outside the plant. The undersize of the screen goes to a Stocker combined scrubber and screen. This is a long scrubbing cylinder with lifters which carry the material 12 times through the water as it makes its way to the end. The feed end of the screen is the lower end and the water and clay run out over a fine screen which separates the sand that may go with them. The sand joins the sand from the screens into which the scrubber discharges.

These screens are conical screens set almost flat. The inner pocket has 1-in. holes and the outer ⅝-in. holes. The undersize of this goes over a gravity screen. Thus two sizes of gravel are made, a coarser size used mainly for concrete aggregate and a "roofing" gravel used principally as a binder course in asphalt roads. Two sizes of sand are produced, a concrete sand and a plastering sand.

This plant has worked the deposit out almost to the boundary lines of the property and the last of the ground is being stripped by an Erie steam shovel in preparation for working. The dragline has been handled so as to work out square corners and leave no unworked ground. A similar plot of ground has been prepared by stripping and work on this will begin as soon as the present ground is exhausted. The two plots are separated by a levee which has been thrown up by the work of stripping and which takes the place of another levee raised to keep the waters of the creek within bounds. At present this stripped ground is being used for gravel storage. When both sides of the plant are worked out the plant will remain on a small island connected by the levee and wagon road to the mainland.



The smaller plant of the skeleton type—and new steel gravel bin

Pump with Remarkable Record

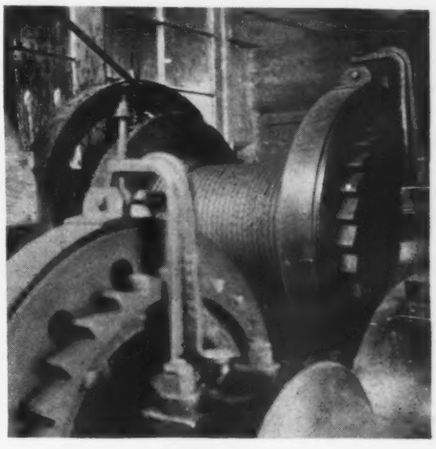
A De Laval centrifugal pump, with a 6-in. discharge pipe, furnishes water for washing the sand and gravel at this plant, and it has a somewhat remarkable record. It has not cost a penny or a day's labor for repairs in the six years that it has been running and Mr. Shearer says he has no recollection of its having been packed in that time.

The production of this plant is supplemented by a smaller plant perhaps 200 yd. distant, which is of the gravity type. The material excavated by the dragline bucket goes from the receiving hopper to a set of gravity screens and the sand and water passing through the sand screen go to a Telsmith automatic settling tank. To provide storage for the sand and gravel, Blaw-Knox circular steel bins with conical bottoms have been added.

The dragline at this plant is operated by the new Sauerman two speed motor hoist. It has two speeds, a very slow speed for digging and a fast speed for pulling the bucket up to the plant. This has the advantage of reducing the strain upon the hoist and cables while the digging is in progress.

The Lewis Concrete Products Co. has two plants on the company's property and secures its aggregate for concrete products from the company's production.

The Indiana Gravel Co. is a closed corporation. Jesse A. Shearer is president and Mrs. Shearer is vice-president. Frank J. Billeter is secretary and treasurer. The office of the company is at the plant. Mr. Shearer is Indiana agent for the Sauerman Bros. Co. which now manufactures and sells the cableway dragline, and the Indiana office of the company is in the same building.



Two-speed hoist for dragline operation

Mining Methods of Six Limestone Plants

Underground Recovery Used to Advantage Where Open-Pit Work Is Not Feasible

By J. R. Thoenen
Consulting Engineer, Greenville, Ohio

EDITORIAL NOTE

THE interest aroused by this series of articles on the mining of limestone has prompted Mr. Thoenen to continue his investigations and compile additional data on the subject. The present article gives notes on six plants where limestone is taken out by mining. These are interesting in themselves, as well as giving this additional evidence of the increasing use of this method of operation.

AT one mine in the Mississippi valley the limestone occurs in a flat stratum 20 ft. thick below a ledge of impure limestone which in turn is capped by a clay mantle. Both the low-grade limestone and clay vary in thickness, the average total being 50 ft. The limestone over-burden is sufficiently strong to provide a good roof in itself without the necessity for leaving any high-grade stone for this purpose.

The room-and-pillar method of mining is used, with rooms 40 ft. wide and 20 ft. high and pillars 20 ft. sq. on 60-ft. centers in both directions.

Rooms are cut by two methods. In one the full height is drilled from a 20-ft. column using a center V or wedge cut with 50 holes placed in ten vertical rows of five each. All holes are drilled 10 ft. deep. In the second method an upper breast 10 ft. high is advanced first and the lower 10 ft. removed by underhand bench. The breast is advanced with holes drilled similarly to those in the former method except that fewer holes are necessary. The underhand bench is then removed by 10-ft. holes drilled on the corners of 4-ft. squares. Each round advancing the full size of the room requires 200 lb. of 30% gelatin dynamite.

Denver Rock Drill Co. "Turbro" drills and Ingersoll-Rand "Jackhamer" drills are used, the former mounted for breast holes and the latter unmounted for block holes and benches. Steel is 1¼-in. and ⅞-in. hollow hexagon with square and 6-point bits.

All broken stone is loaded by hand on contract into carts or wagons. Stone over 4-in. and up to 10-in. size is hauled by horses to the tops of lime kilns, and spalls to a 12x16-in. jaw crusher set at 2 in. Crusher product goes to a 12x6-in. bucket elevator which delivers to a 36-in. by 16-ft. trommel where various sizes of concrete aggregate are made. The minus ¼-in. material goes to the agricultural stone bin and when conditions require it all stone over ¼ in. in size is sent to a 6x12-in. jaw crusher set at ¼ in. and from there to a Kent pulverizer for agricultural stone. The following operating data are of interest:

Tons produced per man in the mine..... 15.0
Tons produced per pound of explosive.. 2.46
Tons produced per foot of drilling..... 1.10

Another mine is located at Osborne, Penn., on the Pennsylvania Railroad. Stone is mined for commercial and agricultural stone. The ledge is flat and averages 16 ft. in thickness. Overburden consists of impure limestones, shales, coal seams and some clay ranging in thickness from 25 to 200 ft. The stratum immediately overlying the good stone is not good roof material and 4 ft. of the high-grade stone must be left for roof protection.

The room-and-pillar method of mining is used, with rooms 35 ft. wide and 12 ft. high. Pillars are left in ribs 30 ft. wide.

Rooms are advanced by the triangular block system, using large and small angles alternately. As mentioned in a previous article, this system of placing holes cannot be accurately described further than to say that all holes are drilled to meet at their inner ends as in the initial cut of the V or wedge system. Each angle is placed to suit conditions in the breast so that while a rough general system may be followed, each individual advance may vary in detail. In this particular case six holes 14 ft. deep are drilled in the large angles and a similar number of 10-ft. holes in the small angles.

Mine entrance from old quarry floor

Denver Rock Drill Co. "Turbro" drills mounted on tripods are used with 1¼-in. round hollow steel and square bits.

A traction type Osgood shovel with ¾-yd. dipper operated by compressed air at 80 to 90 lb. pressure loads 6½-ton wooden front-end-dump cars which are collected by mules and hauled by steam saddle-tank locomotives to the top of a long 3-rail surface incline down which they are lowered by gravity hoist to the crushers.

Gelatin dynamite of 30% strength is used throughout and 16 to 24 angles are blasted in each heading before the shovel is brought in. This necessitates heavy shooting to throw the broken material clear of the face and result is a larger proportional amount of fines or spalls than would be necessary with hand loading. It also increases the explosive costs.

Cars are dumped to a No. 7½ Allis-Chalmers gyratory crusher set at 4 in. Crusher material is elevated in a 12x18-in. bucket elevator to a 48 in. by 18 ft. trommel with round perforations from ¾ to 4 in. diameter. Oversize returns to a No. 5 Allis-Chalmers gyratory delivering to elevator.

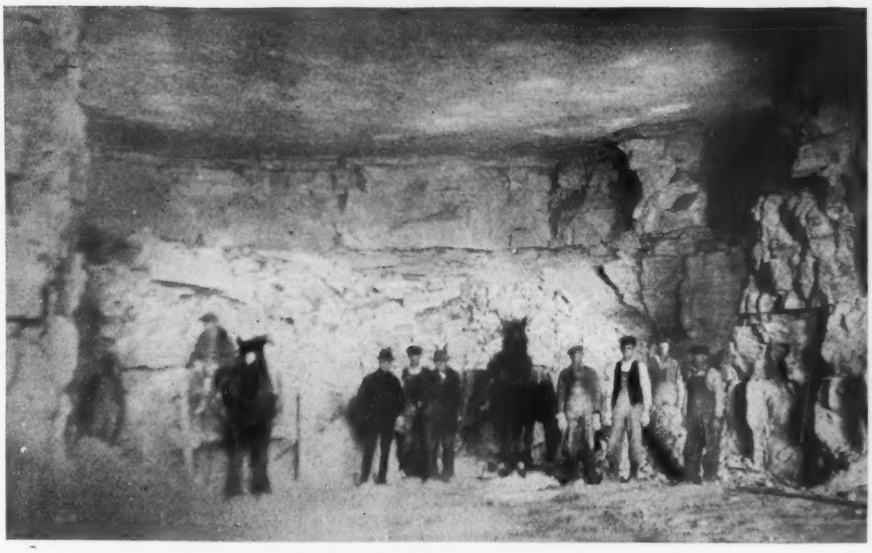
All material from 4 down to 1¼ in. in size is sent to an Allis-Chalmers trommel washer and after washing to bins for loading into railway cars. The 1¼ to ¾ in. material is sent to bins over railway cars, and minus ¾ in. stone to bins which deliver to a 6x36-ft. Ruggles-Coles dryer. After drying this material is sent to a Hardinge conical ball mill using 6 in. to 1½ in. steel balls, where it is ground dry. Fine stone from the ball mill is sacked and sold as agricultural stone. The average operation of this plant yields the following data:

Production per man, 34 tons.
Production per pound of explosive, 0.75 tons.
Production per foot of drilling, 0.87 tons.

Gager Lime and Mfg. Co., Sherwood, Tenn.

This company has just recently started underground mining so that its cycle of operations has not reached a definite stage. It is interesting to note one or two unusual practices here, however.

Stone has been and is being quarried from an extensive open pit for burning to lime in both vertical and rotary kilns. The quarry face is approximately 120 ft. high with an average of 18 ft. of dirt and shale overburden which must be stripped. The stone is massive and lies in horizontal beds from 15 to 30 ft. thick with six strata of a greenish yellow shale between, from 1½ to 3 ft. in thickness. This shale is highly siliceous and must be separated from the stone going to the kilns. In order to produce a particularly clean stone for certain market requirements a tunnel has been started in the quarry face on a 30-ft. ledge of pure high-grade limestone.



Tunnel heading at mine of McManus Quarries Co., Keokuk, Iowa

This tunnel is advanced by a lower heading 18 ft. wide and 16 ft. high with the floor on the same elevation as the open quarry floor. The placing of the holes in the tunnel heading is unique in limestone mining, although quite common in metal mines. The initial cut is made by drilling either three or four holes in the face in such a manner that they meet at their inner ends in a single point. The collars of the holes thus form a triangle or square, depending on whether three or four are used. The resulting blast forms a rough conical or pyramidal opening in the face. Other holes are then drilled to break into this cone similar to those following the wedge in the center V or wedge system. This cut is commonly known in metal mines as the "diamond cut" and is used extensively in very hard rock or ore.

The present plan is to drive this initial tunnel for some distance into the quarry wall, after which the drillers will return to the portal and drill upper holes in the roof for a distance of 14 ft. When this back stope is blasted the resulting tunnel will be roughly 18 ft. in width by 30 ft. in height. It is not planned to carry both breast and back stone simultaneously. No decision has been made as to the ultimate size or shape of the pillars that will be left.

All drilling is done by Denver Rock Drill Co. "Dreadnaught" and "Turbro" drills mounted on 16-ft. columns using 1⅛-in. round hollow steel and 6-point rose bits with dry holes; 20 to 24 holes are drilled in the tunnel heading and back stope holes are spaced 4 ft. with 5 ft. of burden. All holes are shot by electricity using No. 6 caps with time delay exploders and a 40% starch dynamite. Each 8-ft. advance of the tunnel heading (not including the back stope) requires 100 lb. of explosive or each pound of explosive breaks 1¾ tons of stone.

Three-ton rocker type side-dump steel cars are loaded by hand and hauled by a 4-ton Vulcan gasoline locomotive to the top of a gravity incline down which the stone is lowered to the kilns. The crushing and kiln equipment of this plant was described in the Aug. 9, 1924, issue of Rock Products.

A Western Illinois Stone Co.

This operation was started several years ago as an open quarry on the edge of the city. Subsequent growth of the city and the proximity of heavily traveled highways eventually prevented continuance of the heavy open-pit blasting and operations were discontinued, and five years ago mining was started.

Stone handled by derrick at western Illinois plant

The original open pit consisted of an excavation approximately 60 ft. below the level of the adjacent railway siding and street. Stone was hoisted to the crusher by a steam derrick in steel skips or pans loaded in the quarry and pushed to within reach of the derrick on four-wheel trucks. The same method is used to elevate the mine stone to the crusher, skips and trucks being now used as mine cars.

The stone is a massive limestone of unknown thickness. From previous excavations and drill holes in the floor of the old quarry there is known to be at least 30 ft. of good stone below the present mine floor which can be removed at some later date. Overburden consists of clay and shale with some limestone and varies in thickness up to 75 ft., depending on the surface topography. Room-and-pillar methods are in use and rooms are carried 26 ft. wide and 30 ft. high. The mine floor and old quarry floor are on the same level.

Rooms are advanced by the upper breast and underhand bench method using a center V or wedge cut in the breast with 26 to 40 holes. Five holes are drilled in each vertical row and cut holes are sunk to a depth of 14 ft. with the balance or squaring up holes 12 ft. deep. One drill is used on a mining column with two set-ups, one on each side of the center. From each set-up, after drilling the breast holes, the drill is reversed and the bench holes, 12 to 16 in number, are drilled without moving the column. An average of one week is required to drill out breast and bench with one drill.

Denver Rock Drill Co. "Dreadnought" drills are used on columns and Ingersoll-Rand "Jackhamers" for block holes. Holes are blasted with 40% Du Pont gelatin dynamite and electric delay exploders. Hexagon hollow steel in 1 and 1¼-in. sizes is used with 6-point rose bits and all holes are drilled wet. There being a greater demand for rip-rap and lump stone bench holes are drilled 2 ft. below the floor and the fine stone left to accumulate as ballast.

Pans or skips are of steel, 2600 lb. capacity, set on car trucks. They are loaded by hand and pushed to a point below the derrick which hoists them to the crusher or to a by-pass chute delivering to railway cars.

The initial crusher is a No. 5 Austin gyratory delivering to a 8x14-in. bucket elevator on 60-ft. centers. The elevator delivers to a 36 in. by 18 ft. trommel with dust

Unusual tunnel operation at a southern mine

screen, the undersize passing to bins over railway sidings. The following data were secured at this plant:

Production per man in mine, 10 tons.

Production per pound of explosive, 3.45 tons.

Production per foot of drilling, 1.17 tons.

McManus Quarries Co., Keokuk, Iowa

This company's operations present a typical example of the necessity for mining, owing to increasing thickness of overburden. Formerly worked as an open pit, the stone was recovered parallel with the bank of the Mississippi river; but progress at right angles to the bank was prohibited by rising topography. The stone ledge remained horizontal, but the surface rose abruptly in the form of a hill composed of clay and loam from 20 to 70 ft. thick.

The stone is a semi-crystalline limestone in beds 5 to 7 ft. thick showing some flint nodules. Fairly good partings exist between beds and there are some vertical seams present. The stone reaches to a known depth of 160 ft. but only the upper 27 ft. is being mined. Seven feet of this is left to form the roof and support the overburden.

Room-and-pillar methods are used with rooms 35 ft. wide and 20 ft. high. Pillars are left 35 ft. square on 70-ft. centers.

Rooms are advanced by what may be termed an upper wedge cut. Cut holes are first drilled diagonally upward into the face of the room till they reach the roof elevation. A second horizontal row is then drilled below these at a lesser angle. Other similar rows follow till the inclination is too flat for drill cuttings to be easily removed. These holes are then shot and the remaining toe or bench blasted by underhand bench holes. No regular spacing of holes is followed. Cut holes are drilled with stoper drills and the bottom taken up with jackhamers.

Broken stone is loaded by hand into one-horse dump carts and hauled to the No. 5 Allis-Chalmers gyratory crusher set with its receiving hopper at surface level. The crushed stone is elevated in a 7x16-in. bucket elevator to a 40x24-ft. trommel where it is sized and dropped to bins over the railway siding. Oversize is returned to two No. 3 Allis-Chalmers gyratory crushers which deliver to the main elevator. Production to date:

Tons produced per man in the mine, 9.6.

Tons per pound of explosive, 2.18.

Back and breast stope at plant of Gager Lime and Mfg. Co.

A Southern Limestone Mine

At this mine, contrary to the usual practice, the tunnels have been started at the top of the good stone with the tunnel floor approximately 40 ft. above the floor of the old open quarry. Loaded cars from the mine tunnels are pushed by hand over a steel trestle and dumped into the tops of vertical lime kilns. The old open pit was operated on the side of a valley until the quarry face reached a height of some 65 ft. Further progress was stopped by the appearance of high silica stone capping, ranging in thickness from 5 to 100 ft. Using this impure limestone as a roof, tunnels were driven into the face of the quarry 30 ft. wide and 22 ft. high, leaving 40 ft. of good stone below for later recovery. Pillars are left as 30-ft. ribs.

Rooms are advanced with the triangular block system with no regular method of placing angles. Spread of angles and length of holes are left to the judgment of the drillers and the character of the face after the previous blast. Each angle has six holes in two vertical rows of three each.

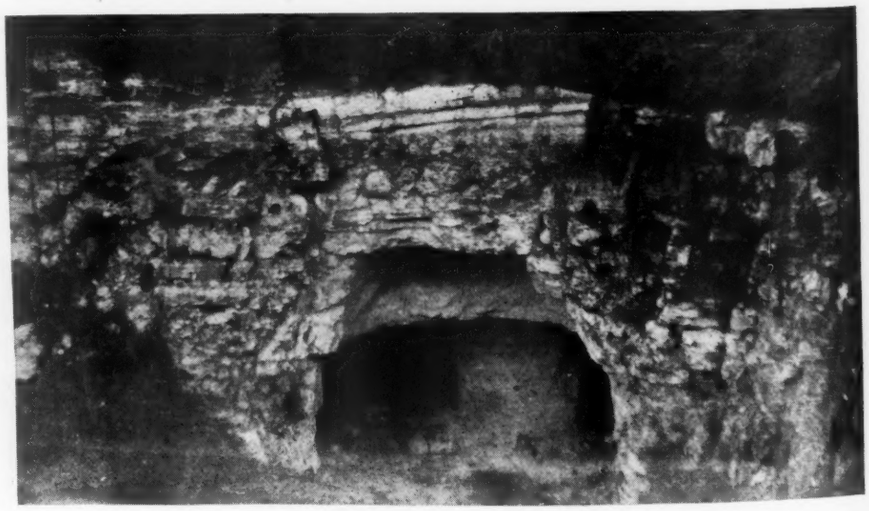
Hardsocg drills mounted with ⅞-in. hollow hexagon steel and 6-point rose bits are used to drill all holes, and they are blasted with 40% gelatin dynamite using both fuse and electric detonators.

"Western" steel front-end-dump cars of 1¼-ton size are loaded by hand and hauled to the portal by mules, then pushed by hand over the trestle to kilns. All spalls are dumped to waste piles at the tunnel portal.

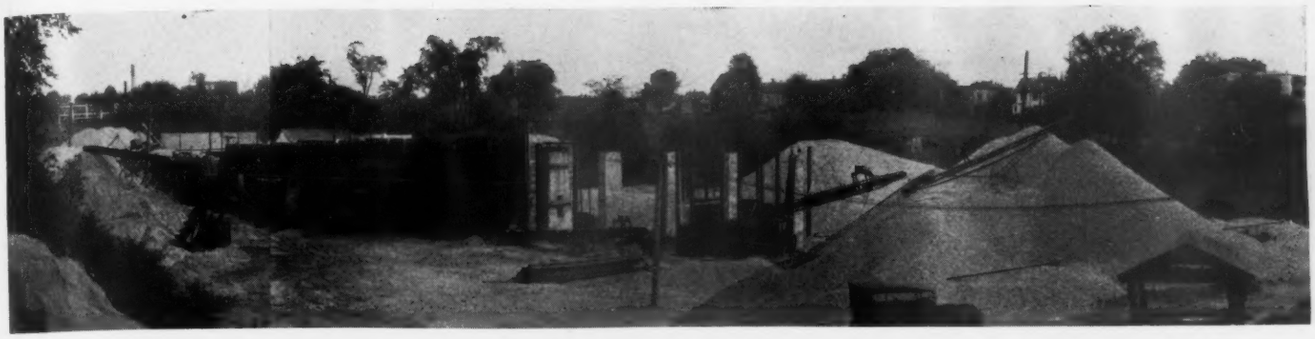
The following results are being secured:

Tons produced per man in mine, 4.0.

Tons produced per pound of explosive, 1.9.



Tunnel entrance at Western Illinois plant



City distributing plant of the Atlas Sand, Gravel and Stone Co., Hartford, Conn.

Some Recent Rock Products Developments in New England

Unique Material-Handling Plant at Hartford—Progress on the New England Portland Cement and Lime Company's Lime Plant

By Nathan C. Rockwood
Editor-Manager, Rock Products

THE ambitious and comprehensive title of this editorial letter is justified only if our readers consider this the first of several articles to come, for even though I spent little over a week in New England, I have found some very interesting developments in the quarry and lime industries, discussions of which we shall have to reserve for a later issue. Probably we of the Middle West are not much accustomed to looking to New England for important developments in the rock products industries, but two I have in mind—the use of motor trucks in place of an industrial railway at the Winchester, Mass., plant of the General Crushed Stone Co., and the marketing of quick lime as pulverized lime by at least two New England lime plants—which are both likely to have almost revolutionary effects in these industries, the one on quarry operating methods, the other on the markets and market demand for lime.

Available space in this issue will make it necessary to confine myself to a very interesting sand and gravel distributing plant at Hartford, Conn., and to a few views of the new lime plant of the New England Portland Cement and Lime Co. at Thomaston, Maine. The sand and gravel plant referred to is that of the Atlas Sand, Gravel and Stone Co., of which Stewart N. Dunning is president. Mr. Dunning is a lawyer by profession, who has made quite a remarkable success in the sand, gravel and sand-lime brick industries.

The plant of the Atlas Sand, Gravel and Stone Co. is some 20 miles from Hartford—too far for economical trucking and too near for an economical railway freight haul. The problem of reaching the Hartford city market had to be solved in some other way, and it has been solved quite successfully by establishing a city distribution and storage yard and bringing the material to this yard by trolley cars. One of the lines of the Connecticut Co., which operates most of the trolley lines in Connecticut, runs by the plant, and since the street railway passenger business has fallen off, the trolley company finds it profitable to haul freight, to the capacity of its lines.

Sand and gravel is brought by trolley in 30-ton capacity dump cars at the rate of approximately 1000 tons a day. The trolley cars run over the tops of the bins and dump directly into the storage bins. Trucks are loaded from the bins by gravity in the usual way. However, it is economical and desirable, from the transportation angle, to handle more material than the bins can hold, and to take care of this material Mr. Dunning has worked out the rather unique system of ground storage illustrated in the accompanying views.

Portable conveyors do the stocking in the yard

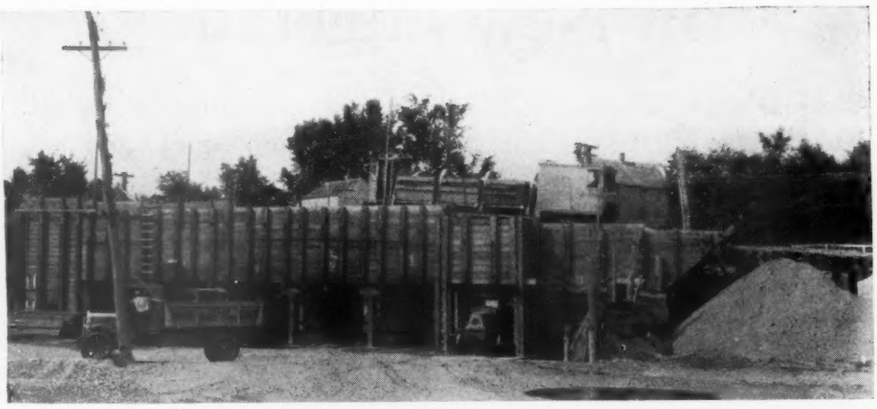
Various types and makes of portable belt conveyors are so placed that any bin may be emptied through them and the material stocked about the yard. As the view at the head of the first page shows, sometimes as many as four conveyors are used in series. The material thus stocked is recovered from the pile with portable wagon or truck

The plant office scales and loader for stock piles

Close-up of stock pile and portable loader for trucks

loaders. While it looks like a costly method, Mr. Dunning assured the writer that the actual cost of handling 1000 tons a day by this means, in and out of the yard, was about 8 cents per ton, which would compare favorably with handling costs with any other system.

The Atlas Sand, Gravel and Stone Co. operates a fleet of motor trucks owned by the company.



Special trolley dump-body car bringing material from plant to bins

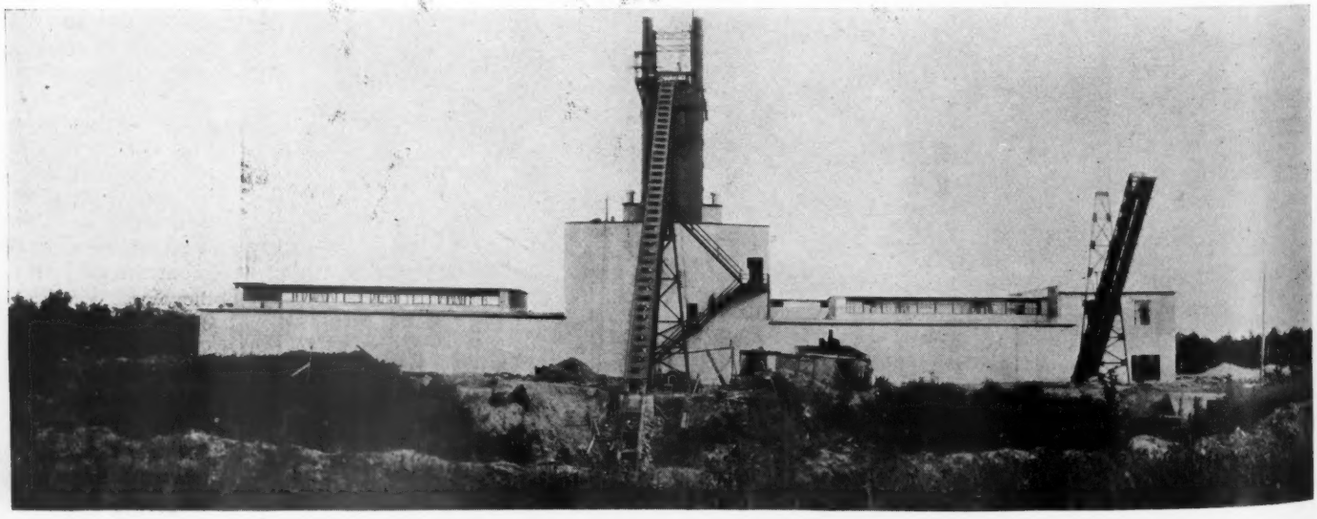
Remarkable New Lime Plant

The new lime plant at Thomaston, Me., about five or six miles from Rockland, will undoubtedly be one of the "show" plants of the industry. The kilns were designed and built by John C. Schaffer, of the Schaffer Engineering Co., and are practically the same as the kilns of the Champlain Valley Lime Co., Winooski, Vt., which have been described in detail in previous issues of Rock Products. The Thomaston kilns have an added feature in the way of steel coal bins built between the kilns, which are quite plainly shown in the accompanying views.

The plant as a whole was designed and construction superintended by W. R. Phillips, former general manager of the National Lime Association, and subsequently general manager of the Amerian Lime and Stone Co., at Bellefonte, Penn., and it certainly would be a credit to any engineer in any industry. The building is structural steel and concrete with corrugated metal siding. The plant is designed with very large, well-lighted packing and shipping rooms and with provision for a hydrating plant. The plant is also designed so that the present two kilns may be added to as desired.

The quarry has been partially stripped and opened up. At the time of the writer's visit (the first week in August) the kilns were being lined and the furnaces, which are to be equipped with mechanical stokers, were being installed. It was expected the kilns would be fired up about the first of November.

At the time of the writer's visit there



New lime plant of the New England Portland Cement and Lime Co., Thomaston, Me.

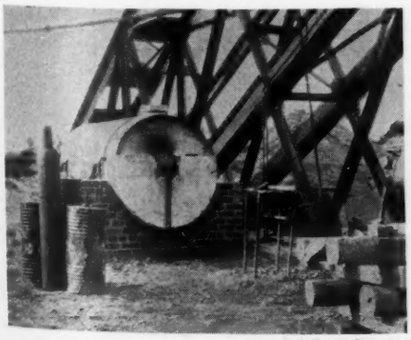
Cooperage plant of the New England Portland Cement and Lime Co.—coal handling conveyor at left

was great local interest in the announcement of the investment of several hundred thousand dollars in the enterprise by the Lawrence Portland Cement Co. of Northampton, Penn. This gives to Lawrence a controlling interest in the other company, assures the early completion of the lime plant, and, according to an announcement by Frank H. Smith, president of the Lawrence Portland Cement Co., means the building of a portland cement plant, adjoining the lime plant, in the near future.

This will give the Rockland district two portland cement plants, for surveys and preliminary engineering work on the proposed new plant of the Consolidated Cement Corp. (the Cowham Engineering Co. project) at Rockland appear to be progressing. Both plants, according to announcements, will have initial capacities of about 2500 bbl. per day. The Lawrence Portland Cement Co.'s "Dragon" brand was formerly very popular in New England, and the company anticipates reinstating its business without much difficulty. The lime will also be sold under the "Dragon" brand name. W. R. Phillips will manage the lime end of the business.

We will forego a description of the lime plant until it has begun operations, but we assure the industry that it has some very interesting and unusual features, and we believe that after it is in operation many progressive lime manufacturers will be inclined to make a pilgrimage to Thomaston to see it. Thomaston is one of the oldest lime manufacturing centers of this country, as lime has been burned there continuously since colonial days.

View of the New England Portland Cement and Lime Co. lime plant looking across the quarry



Experimental lime kiln

Buys Additional Gravel Land

THE Madison Sand and Gravel Co., Hamilton, N. Y., now operating a modern plant near Solsville, N. Y., has purchased additional gravel properties for future reserves located on the road to North Norwich and adjoining land. All of the purchased lands lie between the Lackawanna and the Ontario and Western railroad tracks. A survey made on these deposits is said to have shown a good grade of sand and gravel.—*Utica (N. Y.) Press.*

Rock-dusting Coal Mines with Cement Gun

RECENTLY experiments have been conducted at a coal mine in New Mexico on the use of a cement gun for spreading rock dust. The gun was mounted at the mine entrance and in place of the usual concrete, ejected a stream of fine, dry rock dust into a ventilating current.

The tests indicate that the shale dust was discharged at the rate of a ton per hour. The velocity of the air current in one test was 800 to 1000 lin. ft. per minute at the intake, and about 400 lin. ft. 6000 ft. distant. The dust cloud at this point was dense for a period of 25 minutes after the cement gun was started and definite evidence of dust settlement was found as far as 9000 ft. from the gun. To get an even distribution of dust through an entry it was found necessary to shift the dusting machine.

Stripping the new quarry

Use of Lime in Concrete Roads*

Addition of Lime Hydrate Increases Both Workability and Uniformity

By C. R. Stokes
Manager, Highway Department, National Lime Association

DATA collected during 1924 and 1925 in Wisconsin, Louisiana, Ohio, Connecticut, Virginia, Delaware and Massachusetts show conclusively that lime added to highway concrete makes the mix more uniform, holds the water-cement ratio more nearly constant, improves the finish and riding qualities of the road and imparts the same or greater strength to the concrete. All of this contributes toward the security of the highway investment.

The quantity of hydrate to be used should be measured into a container from the 50 lb. sack. This quantity must be predetermined by taking into account the mix proportions, kind of aggregates, etc. The leaner mixes necessarily will require more of an admixture than the richer ones, but to simplify matters by an example let us say that a five bag batch of 1:2:4 proportions requires the addition of 25 lb. of lime or 5% by weight of the cement. This then is the amount to be added and it may be obtained by cutting a 50 lb. bag in half.

Lime Prevents Segregation and Increases Workability

As the mixed concrete leaves the paver drum and is deposited on the subgrade the necessity of proper consistency is emphasized. If too much water has been used in mixing, the concrete is badly segregated. The mortar is thin and soupy and does not cling to the surface of the aggregates. Concrete of this nature cannot be worked into a dense and compact mass. In sharp contrast, properly mixed concrete containing lime is deposited in a smooth plastic mass, wherein every piece of aggregate is thoroughly coated with thick mortar and the whole batch bonded together into a uniform and homogeneous mixture. A mixture of this character can be easily worked into a dense, watertight slab of concrete. Practice in highway work has demonstrated this repeatedly.

Aside from the practical proof of the greater workability of concrete containing lime, some interesting laboratory experiments have been conducted by J. C. Pearson and F. H. Hitchcock of the U. S. Bureau of Standards. Fig. 1, taken from their paper on "Economic Value of Admixtures," presented at the American Concrete Institute in 1924, shows conclusively that the addition of hydrated lime improved the workability of concrete mixtures. It is further stated in this report that "the improvement in workability which is effected by these maximum additions is about that which should be expected by a 25% increase in the cement content." It would be hard to justify such a cement addition on an economic basis.

The increase in workability which lime imparts to concrete materially broadens the choice of aggregates and make more rigid specifications possible. Lime makes such materials as slag, certain types of crushed rock, coarse sands, etc., which are normally hard to handle, entirely satisfactory so far as workability is concerned.

Better Finishing

With concrete containing lime the lime takes up water so that the concrete when spread out in slab form does not contain any appreciable amount of excess water. In fact, this feature is so pronounced that a roller has been said to be an unnecessary tool for finishing a lime concrete job. This is a decided advantage when a tamping machine is in use, for the belt on the machine can be used during the last tamping operation. On the hand finished job the advantage is also very apparent, for the finishers do not have to wait for the rolling, but can work close behind the tamping operation. It can readily be seen that the danger of "overfinishing" is practically eliminated through the use of lime.

If concrete varies, either with regard to the water content or distribution of materials, cylinder test results will be erratic, some specimens testing high and others low, even though the average may be acceptable. Fig. 2 shows a chart of the results of 28-day test cylinders secured from specimens made in the field at Monroe, La. These specimens were made from the concrete as it was deposited and as they were made regularly throughout the 3.6 miles of pavement they represent the typical concrete secured with an admixture of 5% of hydrated lime. It can be readily seen that with the exception of three groups which went over the 4000 lb. mark, the others are all close to the average line and well within the allowable limit of variation.

(The author further illustrates the uniformity of concrete with hydrated lime by showing how any cracking that occurs follows vertical lines and does not tend to break off corners.—ED.)

Strength

Referring once more to the paper on "Economic Value of Admixtures" presented by Pearson and Hitchcock, the authors state in their conclusions that: "The results of the tests reported herewith indicate that a judicious use of admixture in concrete which needs improvement in respect to workability will not materially impair the strength." This is certainly correct, but to carry it still further, it has been definitely proved by numerous field tests that the use of lime in

TABLE I—WISCONSIN FEDERAL AID PROJECT 319
Field made specimens at 28 days
1:2:4 concrete

	Transverse strength of 4½-in. x 8-in. x 19-in. beams. Mod. of rupture lb. per sq. in.	Compressive strength 6-in. x 12-in. cylinders lb. per sq. in.
No lime	753	2640
	673	1905
	687	2755
Average	704	Average 2433
5% lime	822	2700
	810	2928
	793	3177
Average	808	Average 2935

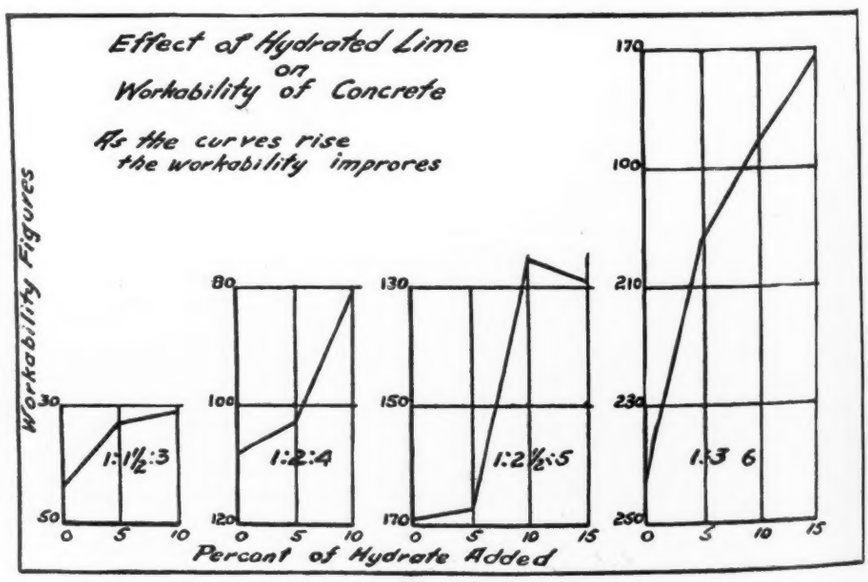


Fig. 1—Showing that hydrated lime improves workability of concrete

*Abstract of paper presented before the Eighth National Lime Association Convention, June, 1926.

the leaner concrete mixtures produces even greater strength. This is easy to believe when it is seen how lime controls the water-cement ratio, the outstanding factor, according to most eminent authorities, that influences the strength of concrete.

The results shown in Tables I and II from two different highway jobs in the state of Wisconsin demonstrate the comparative strength of concrete containing lime with that having no admixture. These specimens were all carefully made and cured in the field by engineers from the highway department and were broken in the highway testing laboratory.

Conclusion

It is readily apparent that lime, when applied to the construction of a concrete road slab, has numerous advantages. It is better to depend on such a well known material to produce the ultimate in satisfactory concrete, rather than to be continually theorizing and guessing as to how the job will come through. The cost of lime is a small item, but when it is considered that it best serves the purpose with the leaner mixes, we are immediately confronted with tremendous saving possibilities. However, the true economy of construction is not so much in the cost of the materials which are involved, but rather the obtaining of a permanent and satisfactory job. Lime is the yard stick by which true construction economy is measured. It is better not to spare on first expense and be assured that the job is so constructed that it will outlive the bonds which financed it. The use of any factor, be it material or method, is more than justified when such things are taken into consideration and the small cost of a few cents per square yard (even this has been more than offset by time and labor saving on most jobs) should not be a barrier, but rather a more than equitable construction cost item.

TABLE II—90-DAY TESTS OF FIELD SPECIMENS FROM JANESVILLE-DELAVAN ROAD, WISCONSIN

Wear results—4½-in. x 8-in. x 19-in. beams—1:2:4

With 5% lime				No lime			
	Weight				Weight		
Specimen	Before	After	Per cent wear	Specimen	Before	After	Per cent wear
J- 1	66.6 lb.	62.2 lb.	6.3%	J-21	69.9 lb.	67.1 lb.	4.0%
J- 3	61.4 lb.	57.6 lb.	6.2%	J-23	59.3 lb.	55.4 lb.	6.6%
J-19	65.3 lb.	62.7 lb.	4.0%	J-25	58.9 lb.	55.2 lb.	6.3%
J- 5	65.5 lb.	61.3 lb.	6.4%	J-27	58.1 lb.	55.0 lb.	5.3%
J- 7	64.8 lb.	61.8 lb.	5.0%	J-29	57.5 lb.	54.5 lb.	5.2%
J- 9	64.0 lb.	60.9 lb.	5.0%	J-32	57.6 lb.	57.6 lb.	6.0%
Average	64.6 lb.	61.0 lb.	5.5%	Average	60.7 lb.	57.4 lb.	5.7%

Transverse Strength
4½-in. x 8-in. x 19-in. beams

With 5% lime		No lime	
Specimen	Lb. sq. in.	Specimen	Lb. sq. in.
J- 5	720 lb.	J-31	1000 lb.*
J- 7	840 lb.	J-33	1000 lb.*
J-19	833 lb.	J-35	930 lb.*
J- 9	840 lb.	J-21	1070 lb.*
J- 3	873 lb.	J-25	860 lb.
J- 1	962 lb.	J-23	910 lb.
J-12	1053 lb.*	J-27	850 lb.
J-15	1121 lb.*	J-29	870 lb.
J-17	940 lb.*	J-32	725 lb.
	920 lb.		912 lb.

*Specimens were not in the rattler before cross bending.

Compressive Strength
6-in. x 12-in. cylinders made concurrently with beams

With 5% lime		No lime	
Specimen	Lb. sq. in.	Specimen	Lb. sq. in.
J- 1	4130 lb.	J-21	3050 lb.
J- 3	4700 lb.	J-31	3480 lb.
J- 5	4550 lb.	J-33	4100 lb.
J- 7	4200 lb.	J-35	3820 lb.
J- 9	3970 lb.	J-29	3490 lb.
J-12	3440 lb.	J-27	3370 lb.
J-15	3660 lb.	J-23	3560 lb.
J-17	3520 lb.	J-25	3240 lb.
Average	4021 lb.		3514 lb.

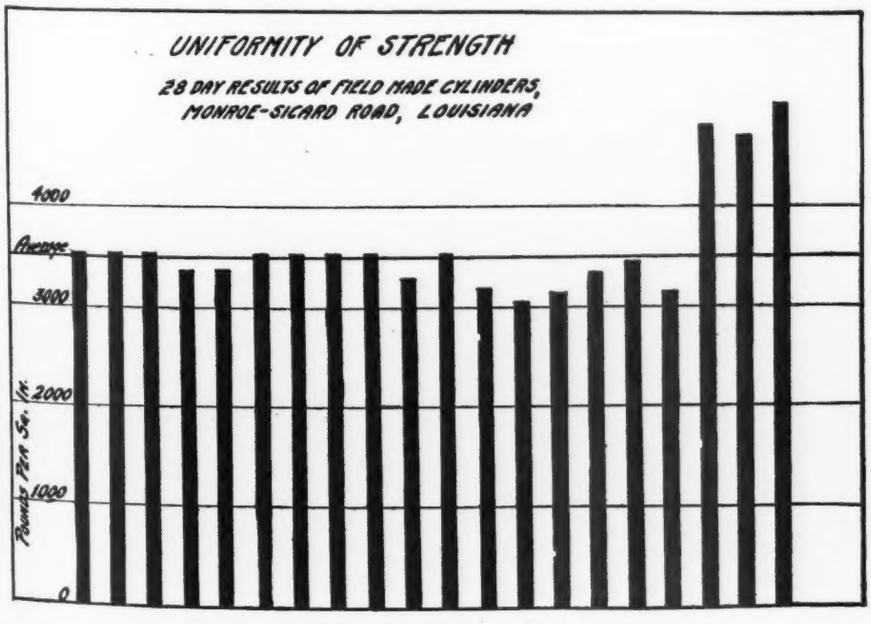


Fig. 2—Result of tests made in Louisiana highway work

Action of Sodium and Magnesium Sulfates on Cement

IN previous experiments carried out by G. R. Shelton, the action of sulfate solutions on the separate compounds found in portland cement and also on the calcium aluminates, were studied. Results were given in *Industrial and Engineering Chemistry*, Vol. 17, pp. 589, 1267 (1925), and in abstract form in Rock Products for Oct. 3, 1925, and May 1, 1926.

Another investigation was carried on to determine the difference in sulfate action on portland cement clinker and on its compounds taken separately. The experiments were made using the same sulfate solutions with a standard and a white portland cement.

The following abstract from the August number of *Industrial and Engineering Chemistry* summarizes the results:

White portland cement made by heating to a high temperature an intimate mixture of powdered marble, alumina and flint, in the proper proportions, contained the three compounds, tricalcium aluminate, tricalcium silicate and β-dicalcium silicate.

The reactions of the white cement were different from those of commercial cement when both were similarly treated with solutions of sodium and magnesium sulfates. An instance of this difference was the appearance of gypsum in the tests with crystalline commercial cement, but not in the tests with white crystalline cement. Again the reaction products of white cement with sulfates were more like those of the pure cement constituents than those of standard cement.

Again the difference in character of the hydrated cements was very apparent, fine sulfo-aluminate needles being abundant in the hydrated commercial cement, while none were found in the white cement. Lastly, the crystalline grains, as centers of gelatinous particles, lasted for a much longer time in the white cement than they did in the commercial cement. Possibly these differences may be due to the small amount of ground gypsum added to the commercial cement and also to its greater percentage of magnesium and ferric oxides.

The presence of silicates seemed to have influenced the speed of disintegration of hydrated tricalcium aluminate crystals, since in the tests with the two varieties of cement and solutions of sodium sulfate these crystals lasted for a much shorter time than they did in the tests with pure hydrated tricalcium aluminate. Solutions of magnesium sulfate were especially destructive in their action on crystals of hydrated tricalcium aluminate, regardless of the presence or absence of calcium silicate.

The character of the layers surrounding crystals of hydrated lime varied with the sulfate solutions used. In sodium sulfate the layers were apparent only on the edges of the lime crystals and were made up of granular masses. In magnesium sulfate solutions the lime crystals were heavily enveloped.

German Method of Proportioning Raw Cement Materials*

Combining Two or Three Raw Materials to Produce a High-Lime Portland Cement

By H. Nitzsche

Translated from the German by J. J. Landy, Assistant Editor of Rock Products

THE principles which are described below are concerned with the proper proportioning of two and three raw cement materials. These materials shall be designated as I, II and III. For the calculations involving the correct mixing of these materials, the standards used are the hydraulic index and the silica modulus of the clinker. The derivation of the proportioning equations are based on the following calculations and tables:

Symbols Used for Percentages in Raw Materials After Igniting

	Raw material I	II	III
CaO	c_1	c_2	c_3
SiO_2	s_1	s_2	s_3
Al_2O_3	a_1	a_2	a_3
Fe_2O_3	e_1	e_2	e_3
$R_2O_3 = (Al_2O_3 + Fe_2O_3)$	r_1	r_2	r_3
$SiO_2 + R_2O_3$	h_1	h_2	h_3
Moisture and ignition loss of the natural material	v_1	v_2	v_3
$f = \frac{100}{100 - v}$	f_1	f_2	f_3

Problem A

Two raw materials, I and II, are to be proportioned.

In order to arrive at the determined hydraulic modulus (H), 1 molecular weight of material I must be added to m molecular weights of material II, and since

$$H = \frac{CaO}{SiO_2 + R_2O_3} = \frac{c_1 + mc_2}{h_1 + mh_2}$$

it follows that

$$m = \frac{c_1 - H \cdot h_1}{H \cdot h_2 - c_2} \qquad [1]$$

Passing to the silica modulus (S) we have

$$S \text{ (silica modulus)} = \frac{SiO_2}{R_2O_3} = \frac{s_1 + ms_2}{r_1 + mr_2}$$

and solving for $m = \frac{s_1 - Sr_1}{S \cdot r_2 - s_2}$ [2]

The mixture of the ignited raw materials in terms of unit of weight then becomes:

$$M = \frac{1}{1+m}(I) + \frac{m}{1+m}(II) \qquad [3]$$

For the natural (unignited) raw materials this is expressed by the equation

$$M_t^1 = 1 \cdot f_1 (I) + mf_2 (II)$$

which expressed in per cent becomes

$$M_t = \frac{100\, f_1}{f_1 + mf_2}(I) + \frac{100\, mf_2}{f_1 + mf_2} \qquad [4]$$

Zement (1926), 20, 351-354.

THAT there may be a great deal of interest — and some difference of opinion—concerning such a purely technical matter as calculating raw materials for making portland cement has been shown by recent articles in Rock Products. The first of these, by Wm. A. and Edgar A. Ernst, published June 12, 1926, was quickly commented upon by G. R. Brobst and followed by the scholarly discussion of the subject by Richard K. Meade, published in the Aug. 21 issue. This was perhaps as full a presentation as has been given of the American view of the constitution of portland cement.

The article presented here treats the subject of combining materials in a purely mathematical way. Symbols are used for the percentages of each element in the raw materials and formulas are derived algebraically for the lime limit, silica ratio and combining ratio of ignited and unignited materials. Substitutions in the formulas permit rapid calculation of the quantities.—The Editors.

The percentage to be added for difference in weight of ignited over the unignited raw materials is

$$A = 100\frac{1+m}{f_1 + mf_2} \qquad [5]$$

If it is desired to keep within the prescribed moduli H or S and at the same time have a definite limitation of the lime content (Kg), the well known molecular proportioning formula of Kuhl and Knothe† is used. This formula is expressed as follows:

$$Kg \text{ (lime limit)} = \frac{CaO\ (56.13)}{SiO_2\ (60.4) + Al_2O_3\ (102.2) + Fe_2O_3\ (319.52)} \left(\begin{matrix} \geq 3 \\ \leq 3 \end{matrix}\right)$$

Dividing by the molecular weight of CaO (56.13) we get

$$Kg = \frac{CaO}{0.929 \cdot SiO_2 + 0.549\, Al_2O_3 + 0.176\, Fe_2O_3}$$

From this the equations for proportioning materials I and II are:

$$Kg = \frac{c_1 + mc_2}{0.929\ (s_1 + ms_2) + 0.549\ (a_1 + ma_2) + 0.176\ (e_1 + m \cdot e_2)}$$

†See Chemie der Hydraul. Bindemittel.

which can be written as

$$m = \frac{c_1 - Kg\ (0.929\, s_1 + 0.549\, a_1 + 0.176\, e_1)}{Kg\ (0.929\, s_2 + 0.549\, a_2 + 0.176\, e_2) - c_2} = \frac{c_1 - Kg\, z_1}{Kg \cdot z_2 - c_2}$$

where $z_1 = 0.929\, s_1 + 0.549\, a_1 + 0.167\, e_1$

and $z_2 = 0.929\, s_2 + 0.549\, a_2 + 0.176\, e_2$

Example

	Raw materials I: Limestone (ignited)	I: Limestone (unignited)	II: Clay marl (ignited)	II: Clay marl (unignited)
Moisture	0.37	.....	3.56	.....
Loss on ignition	43.01	.....	5.72	.....
SiO_2	1.97	3.48	57.30	63.20
Al_2O_3	0.58	1.02	28.02	30.87
Fe_2O_3	0.21	0.37	4.48	4.93
CaO	54.00	95.37	0.88	0.97
MgO	traces	traces	traces	traces
SO_3	traces	traces	traces	traces
Residue	.....	.....	0.04	0.04

Hence we may substitute in the formula the following values:

$s_1 = 3.48$	$s_2 = 63.20$
$a_1 = 1.02$	$a_2 = 30.87$
$e_1 = 0.37$	$e_2 = 4.93$
$r_1 = 1.39$	$r_2 = 35.80$
$c_1 = 95.37$	$c_2 = 0.97$
$h_1 = 4.87$	$h_2 = 99.00$
$f_1 = 1.766$	$f_2 = 1.102$

If the value for H (the hydraulic modulus) is set at 2.0 it follows that

[1] $m = \frac{95.37 - 2.0 \cdot 4.87}{2.0 \cdot 99.0 - 0.97} = 0.435$

[2] $S = \frac{3.48 + 0.435 \cdot 63.20}{1.39 + 0.435 \cdot 35.80} = 1.83$

[3] $M = \frac{1}{1.435}(I) + \frac{0.435}{1.435}(II) = 0.697\ (I) + 0.303\ (II)$

[4] $M_t = \frac{100 \cdot 1.766}{1.766 + 0.435 \cdot 1.102}(I) + \frac{100 \cdot 0.435 \cdot 1.102}{2.245}(II)$

$M_t = 78.66\ (I) + 21.34\ (II)$

[5] $A = \frac{100 \cdot 1.435}{2.245} = 63.9\%$

The theoretical clinker analysis (without taking account of addition of gypsum and the ash content) is shown to be

SiO_2	21.45%
Al_2O_3	10.07%
Fe_2O_3	1.76%
CaO	66.80%

H = 2.01
S = 1.82
Kg = 2.6

In order to approach the extreme lime contents, where Kg = 2.9 (high lime portland cement) it is found that the values for Z_1 and Z_2 must be as follows:

$Z_1 = 0.929 \cdot 3.48 + 0.549 \cdot 1.02 + 0.176 \cdot 0.37 = 3.858$

$Z_2 = 0.929 \cdot 63.20 + 0.549 \cdot 30.87 + 0.176 \cdot 4.93 = 76.528$

[6] $m = \frac{95.37 - 2.9 \cdot 3.858}{2.9 \cdot 76.528 - 0.97} = 0.381$

$S = \frac{3.48 + 0.381 \cdot 63.20}{1.39 + 0.381 \cdot 65.80} = 1.83$

and $H = \frac{95.37 + 0.381 \cdot 0.97}{4.87 + 0.381 \cdot 99.00} = 2.25$

Problem B

Proportioning with three raw materials, I, II and III.

In this problem it is desired to proportion the materials I and II with the addition of III so as to satisfy modulus S, then out of these mixtures, get a proportion that will satisfy H (hydraulic index).

The calculation proceeds as follows: Let m_I and m_{II} be the mixing proportion values to satisfy S (silica modulus), then

$$\left.\begin{array}{ll} \text{(I and III)} & m_I = \frac{s_1 - S \cdot \gamma_1}{S \cdot \gamma_3 - s_3} \\ \text{(II and III)} & m_{II} = \frac{S_2 - S \cdot \gamma_2}{S \cdot \gamma_3 - s_3} \end{array}\right\} \quad [7]$$

The corresponding mixtures are:

$M_1 = 1 \cdot (I) + m_I\,(III)$

$M_2 = 1 \cdot (II) + m_{II}\,(III)$

M_1 and M_2 are so to be mixed that the mixture $M = M_1 + m\,M_2$ satisfies the hydraulic index H.

If e', s', r', etc., represent the analytical figures for M_1 and M_2 and

$$m = \frac{c_1' - H \cdot h_1'}{H\,h_2' - c_2'}$$

where

$$c_1' = \frac{c_1 + m_I\,c_3}{1 + m_I} \qquad h_1' = \frac{h_1 + m_I\,h_3}{1 + m_I}$$

$$c_2' = \frac{c_2 + m_{II} \cdot c_3}{1 + m_{II}} \qquad h_2' = \frac{h_2 + m_{II}\,h_3}{1 + m_{II}}$$

and from this we get

$$m = \frac{1 + m_{II}}{1 + m_I} \cdot \frac{m_I\,(c_3 - H \cdot h_3) + c_1 - H \cdot h_1}{m_{II}\,(H\,h_3 - c_3) - c_2 + H \cdot h_2} \quad [8]$$

which for the ignited raw materials gives the following:

$M = \alpha \cdot (I) + \beta\,(II) + \gamma\,(III)$ [9]

where
$$\left.\begin{array}{l} \alpha = \frac{1}{1+m} \cdot \frac{1}{1+m_I} \\ \beta = \frac{1}{1+m} \cdot \frac{m}{1+m_{II}} \\ \gamma = \alpha \cdot m_I + \beta\,m_{II} \end{array}\right\} \quad [9a]$$

For the natural raw materials expressed in percentages we get

$$\alpha \cdot f_1 + \beta \cdot f_2 + \gamma f_3 = n$$

$$M_t = \frac{100\,\alpha \cdot f_1}{n}(I) + \frac{100\,\beta \cdot f_2}{n}(II) + \frac{100\,\gamma \cdot f_3}{n}(III) \quad [10]$$

The percentage to be added for difference in weight of ignited over the unignited materials is

$$A = \frac{100}{n} \quad [11]$$

If it is desired to keep within the lime limits, through the use of the above corresponding algebraic operations, we get the following equations:

$$m = \frac{1 + m_{II}}{1 + m_I} \cdot \frac{c_1 + m_I \cdot c_3 - Kg\,(z_1 + m_I \cdot z_3)}{Kg\,(z_2 + m_{II} \cdot z_3) - c_2 - m_{II} \cdot c_3} \quad [12]$$

where

$z_1 = 0.929 \cdot s_1 + 0.549 \cdot a_1 + 0.176 \cdot e_1$

$z_2 = 0.929 \cdot s_2 + 0.549 \cdot a_2 + 0.176 \cdot e_2$

$z_3 = 0.929 \cdot s_3 + 0.549 \cdot a_3 + 0.176 \cdot e_3$

Formulas 9, 9a, 10 and 11 further extend the application.

Example of Application

	Raw materials: I Limestone		II Limestone		III Clay marl	
Moisture, Loss on ignition	37.75	.....	43.84	.....	10.10	.....
SiO_2	12.00	19.27	0.16	0.28	58.30	64.83
Al_2O_3	1.73	2.78	0.06	0.11	22.76	25.31
Fe_2O_3	0.52	0.84	0.02	0.04	3.49	3.88
CaO	45.70	73.39	55.40	98.67	2.30	2.56
MgO	2.15	3.45	0.43	0.77	1.65	1.83
Residue	0.15	0.27	0.09	0.13	1.40	1.59

Hence the following values may be substituted in the formulas:

$s_1 = 19.27$	$s_2 = 0.28$	$s_3 = 64.83$
$a_1 = 2.78$	$a_2 = 0.11$	$a_3 = 25.31$
$e_1 = 0.84$	$e_2 = 0.04$	$e_3 = 3.88$
$c_1 = 73.39$	$c_2 = 98.67$	$c_3 = 2.56$
$h_1 = 22.89$	$h_2 = 0.43$	$h_3 = 94.02$
$r_1 = 3.62$	$r_2 = 0.15$	$r_3 = 29.19$
$f_1 = 1.606$	$f_2 = 1.781$	$f_3 = 1.112$

If S = 2.6 and H = 2.0, then

[7] $m_I = \frac{19.27 - 2.6 \cdot 3.62}{2.6 \cdot 29.19 - 64.83} = 0.894$

$m_{II} = \frac{0.28 - 2.6 \cdot 0.15}{2.6 \cdot 29.19 - 64.83} = -0.0076$

[8] $$m = \frac{0.9924}{1.894} \times \frac{0.894(2.56 - 2.0 \cdot 94.02) + 73.39 - 2.0 \cdot 22.89}{-0.0076\,(2.0 \cdot 94.02 - 2.56) + 2.0 \cdot 0.43 - 98.67}$$

m = 0.730.

[9a] $\alpha = \frac{1}{1.730 \cdot 1.894} = 0.305$

$\beta = \frac{0.730}{1.730 \cdot 0.9924} = 0.425$

$\gamma = 0.305 \cdot 0.894 - 0.425 \cdot 0.0076 = 0.270$

[9] $M = 0.305(I) + 0.425\,(II) + 0.270(III)$

and when n = 1.547

[10] $M_t = 31.68(I) + 48.93(II) + 19.39(III)$

[11] $A = \frac{100}{1.547} = 64.7\%$

Theoretical clinker analysis:

S_iO_2	23.50%
Al_2O_3	7.73%
Fe_2O_3	1.32%
CaO	65.01%
MgO	1.87%
Residue	0.57%

H (hydraulic index) = 2.0
S (silica modulus) = 2.6
Kg (lime limit) = 2.4

If it is desired to attain a value of 2.6 for S and 2.8 for Kg, then it follows that

[12a] $Z_1 = 17.902 + 1.526 + 0.149 = 19.577$

$Z_2 = 0.260 + 0.060 + 0.007 = 0.327$

$Z_3 = 60.227 + 13.895 + 0.683 = 74.805$

and

[12] $$m = \frac{0.9924}{1.894} \times \frac{73.39 + 0.894 \cdot 2.56 - 2.8\,(19.577 + 0.894 \times 74.805)}{-98.67 + 0.0076 \cdot 2.56 + 2.8\,(0.327 - 0.0076 \times 74.805)}$$

$$\alpha = \frac{1}{1.878 \cdot 1.894} = 0.281$$

$$\beta = \frac{0.878}{1.878 \cdot 0.9924} = 0.471$$

$\gamma = 0.281 \cdot 0.894 - 0.471 \cdot 0.0076 = 0.248$

$M = 0.281\,(I) + 0.471\,(II) + 0.248\,(III)$

$n = 0.281 \cdot 1.606 + 0.471 \cdot 1.781 + 0.248 \cdot 1.112 = 1.566$

$M_t = 28.8(I) + 53.6(II) + 17.6(III)$

$A = \frac{100}{1.566} = 64.0\%.$

The analysis of clinker made by this proportioning gives:

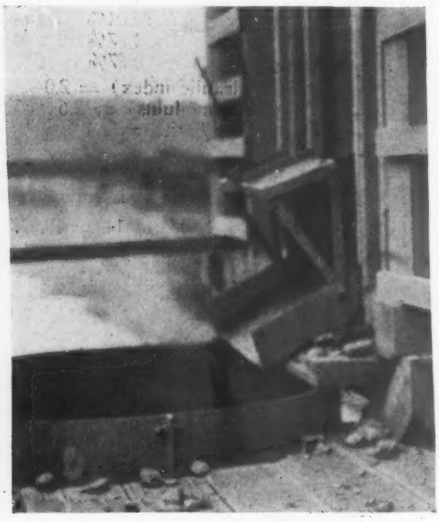
SiO_2	21.62%
Al_2O_3	7.11%
FeO_3	1.22%
CaO	67.73%
MgO	1.79%
Residue	0.53%

H (hydraulic index) = 2.26
S (silica modulus) = 2.6
Kg (lime limit) = 2.8.

Hints and Helps for Superintendents

Regulating Plant Feed at Crusher Bin

AT the plant of the Madison Sand and Gravel Corp. at Solsville, N. Y., a considerable part of the gravel is crushed. The oversize of the main screen falls to a bin and then to a crusher. When the bank run is heavy in gravel the crusher discharge becomes so heavy that it cannot be efficiently handled by the bucket and belt elevator which takes it to the screen and the screen itself is too crowded to do good work.



Gate used to regulate crusher feed

For this reason the flow from the bin to the crusher has to be regulated by the man at the screen who can see when the feed is too heavy. At first he called down to the crusher man, but often the crusher man did not hear him and the screen became overcrowded before the feed to the crusher was stopped.

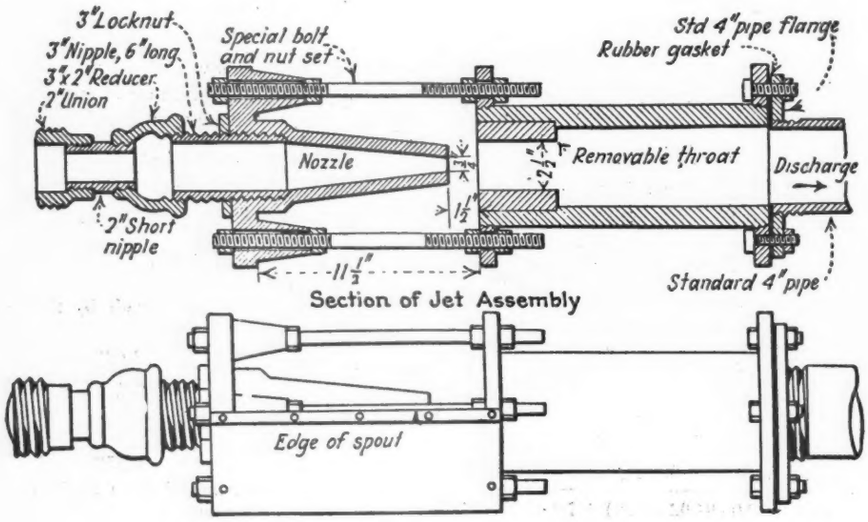
C. A. Adams, the plant superintendent, then rigged up the gate shown here. The gate is heavy enough to fall by its own weight when the rope which holds it is loosened, thus cutting off the crusher feed. It can be easily raised as soon as the danger of crowding has passed. The bin receives the extra feed and acts as an equalizing bin, so that the work of the plant is not interrupted.

Removing Mud Balls from Sand

AUGUST V. GRAF, chemical engineer of the St. Louis Water Works, writes in the *Engineering-News Record* of the method he uses for removing mud balls from sand. It is merely to pass the sand through a hydraulic ejector and then wash it to carry away the mud balls that have been broken up. The ejector or jet used by Mr. Graf is shown in the accompanying illustration. It is a rather elaborate device compared to some "home made" ones that have been used for the same purpose, but it should be efficient.

To use, the ejector may be placed in a box into which the sand and water are fed. The discharge pipe and pressure water pipe pass through the sides of the box, with flanges.

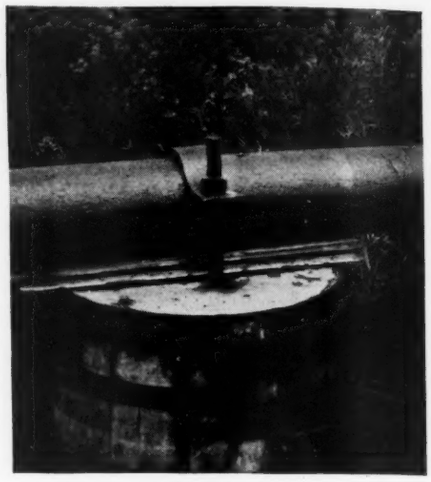
This method of washing sand has been considerably used in the silica sand industry, in Oklahoma, for example. It is efficient and the apparatus required is inexpensive. For large scale work the power bill would probably be higher than for some other kinds of scrubbers.



Hydraulic ejector used to remove mud balls from sand

Cheap and Solid Support for Pipe

A CHEAP and simple method of making a good support for a pipe line is shown in the accompanying picture. A barrel is sunk in the earth so as to bring its top to the right height and filled with large stones and concrete. The concrete should be placed so that the stones are embedded in it, the purpose of the stones being to save cement. In the upper part two anchor bolts are set and concrete poured around them. These bolts serve to hold a strap which holds the pipe in place as shown in the cut.



Old barrel filled with concrete makes good pipe support

Even though the barrel should rot away, the suport will be permanent and will hold the pipe in line.

Automatic Interlocking Conveyor System

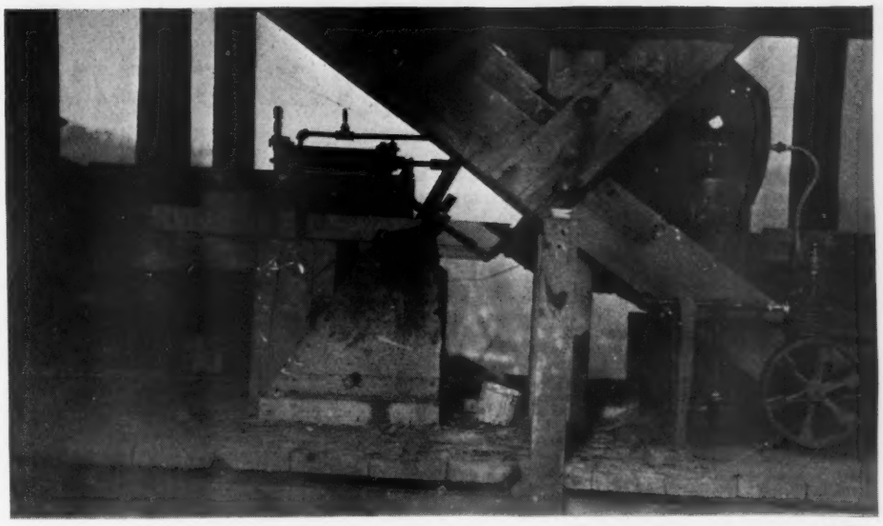
QUARRY operations sometimes make necessary the developments of new workings at a considerable distance and elevation from the old. To carry on work at the old and new deposits simultaneously and use the screening, storage and loading systems already in place is usually quite a problem. The Lincoln Coal Co., Nipfor, Ky., recently installed a conveyor system for hauling coal from a new mine to a tipple which with a few changes could be easily transformed into an efficient quarry operation. The interlocked conveyor system, as it is called, is said to be entirely automatic and pays for its own maintenance by means of regeneration of electricity.

The tramway is of the automatic continu-

ous carrier type and was built by the Interstate Equipment Corp. It operates over a distance of 1800 ft. with a drop of 360 ft. from the loading to the unloading end and has a capacity of 150 tons per hour. The system is started by a 40-hp. motor which, after the speed builds up, acts as a generator and feeds power back into the line. The motor also, by this regenerative process, acts as a brake, thus preventing the conveyor from running away. The power fed back into the line is used by other motors on the system, such as the screen motor. A solenoid brake is provided for the purpose of stopping the conveyor in the event that a failure of power were to make the motor inoperative for braking.

Two mines are operated by the Lincoln company at this point, both on the same side of a river, while the tipple is on the other side of the river. Coal is transported from the old mine to the tipple in cars drawn by electric locomotives, while the supply from the new mine is delivered at the tipple by means of the automatic conveyor system. Both supplies of coal are delivered to the same screen and after screening are loaded on cars on three different railroad tracks.

Coal is taken from the new mine in 1½-ton cars which discharge into a Jeffrey weigh basket at the head of the tramway. From the weigh basket a Jeffrey reciprocating feeder deposits the coal on a Jeffrey apron conveyor used as a picking table which, in turn, deposits the coal in an undercut gate emptying into the main tramway loader. The tramway cars, each with a capacity of 1000 lb. of coal, pass through the receiving terminal of the conveyor system at 10½-second intervals. The conveyor proper consists of two stationary tension cables used as tracks on which the tramway cars ride by means of four grooved wheels, and a single moving cable to which the cars are fixed and which keeps the cars in motion. The motor which furnishes the power for starting the system through the moving cable is located at the receiving end of the system. Another motor drives the picking table and feeder, and both motors are controlled by push buttons at the tipple, 1800 ft. away. General Electric motors and control are used.



The single-acting air hoist controlling the movement of the undercut gate

The movement of the undercut gate at the receiving end of the system is controlled by a single-acting air hoist, the operation at this point being an important part of the system. The conveyor which acts as a picking table feeds just enough coal into the hopper to equal the rate at which the coal is taken away in cars on the cableway. In order to avoid any dribbling of coal between cars, the undercut gate is operated at definite points in a predetermined cycle. As the returning empty cars pass under the hopper an air valve is operated, causing the gate to close at the bottom of the picking table and stopping the flow of coal into the tramway loader. At a point a short distance farther the empty car trips the hopper gate and the car is filled with coal. Having emptied the hopper, the car moves on and strikes another valve, releasing the air and causing the gate at the discharge end of the picking table to reopen and refill the hopper. By locating this last valve sufficiently far from the hopper, enough time elapses before the picking table gate reopens to allow the hopper discharge gate to close.

Among the advantages which are said to have resulted from the automatic conveyor system are reduction of labor as compared with the older haulage system; reduction of operating cost, the power delivered back to the line more than paying for the maintenance cost, and minimum breakage of coal, there being no drops and very little sliding in handling. It is in line with the general trend of conveying methods.

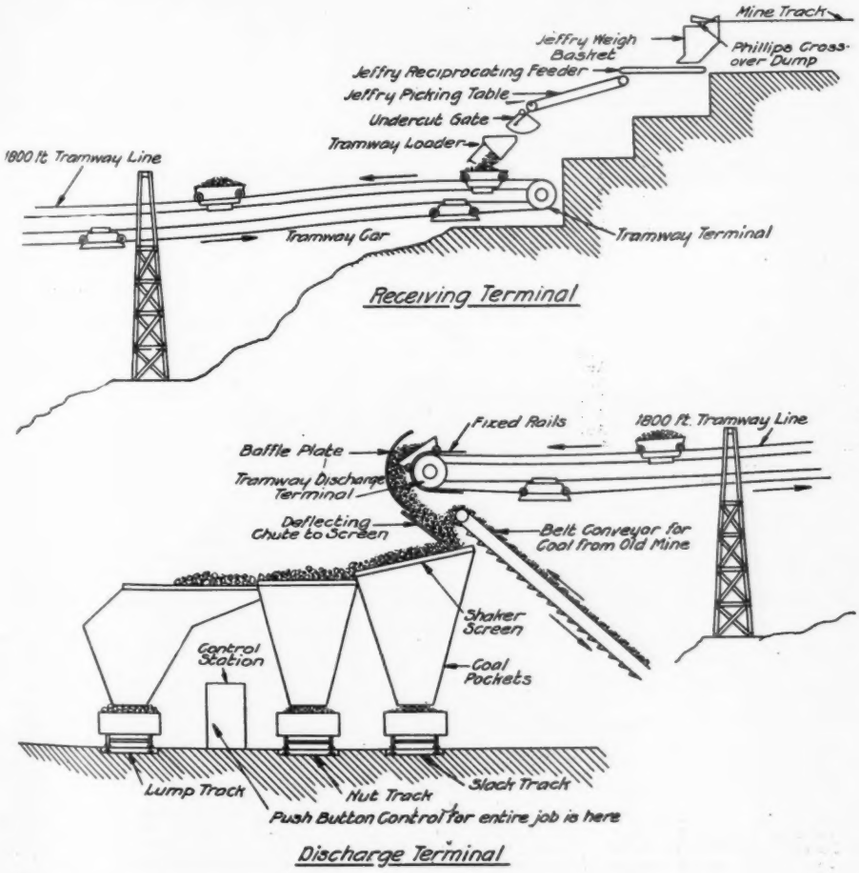


Diagram of the interlocking conveyor system showing how material from new and old mines discharge simultaneously onto the same screen

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Alpha Portland Cement Co. (common)[2] new stock	Aug. 30	No par	44½	47	1½% quar. Apr. 3
Alpha Portland Cement Co. (preferred)[2]	Aug. 30	100	115	.....	1¾% quar. Mar. 1
Arundel Corporation (sand and gravel—new stock)	Aug. 30	No par	35½	36	45c qu., 15c ext. July 1
Atlantic Gypsum Products Corp. (1st 6's carrying 10 sh. com.)[10]	Aug. 31	100	102	103	
Atlas Portland Cement Co. (common)[2]	Aug. 30	No par	44½	46	50c quar. Sept. 1
Atlas Portland Cement Co. (preferred)	.....	100	.....	.....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)[2]	Aug. 30	33⅓	43	46	2% quar. July 1
Beaver Portland Cement Co. (1st Mort. 7's)[8]	July 29	100	100	100	
Bessemer Limestone and Cement Co. (common)[4]	Aug. 30	100	130	135	1½% quar. June 30
Bessemer Limestone and Cement Co. (preferred)[4]	Aug. 30	100	107	109	1¾% quar. June 30
Bessemer Limestone and Cement Co. (convertible 8% notes)[6]	Aug. 30	.....	117	125	8% annual
Boston Sand and Gravel Co. (common)[10]	Aug. 27	100	60	63	2% quar. July 1
Boston Sand and Gravel Co. (preferred)[10]	Aug. 27	.....	.....	75	1¾% quar. July 1
Boston Sand and Gravel Co. (1st preferred)[10]	Aug. 27	.....	.....	83	2% quar. July 1
Canada Cement Co., Ltd. (common)	Aug. 31	100	106	107	1½% quar. July 16
Canada Cement Co., Ltd. (preferred)[11]	Aug. 28	100	113½	114	1¾% quar. Aug. 16
Canada Cement Co., Ltd. (1st 6's, 1929)[11]	Aug. 28	.....	102	103	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	Aug. 28	100	93	96	
Charles Warner Co. (lime, crushed stone, sand and gravel)	Aug. 27	No par	22	24	50c quar. July 12
Charles Warner Co. (preferred)	Aug. 27	100	99	102	1¾% quar. July 22
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929[16]	Aug. 27	100	102	103½	
Cleveland Stone Co. (new stock)	Aug. 30	.....	67	68	$1.50 qu. Sept. 1
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	Aug. 27	100	104	.....	
Consolidated Cement Corp. (1st Mort., 6½s, series A)[24]	Aug. 31	.....	94	98	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	Aug. 31	100	94½	100	
Consumers Rock and Gravel Co. (1st Mort. 7s)[18]	Aug. 26	100	99	101	
Dexter Portland Cement Co. (6% serial bonds, 1935)[25]	Aug. 31	.....	99	.....	
Dolese and Shepard Co. (crushed stone)[7]	Aug. 31	50	91	93	$1.50 quar. July 1, $1 ex. July 1
Egyptian Portland Cement Co. (7% pfd. with com. stock purchase warrants)[21]	Aug. 27	.....	95	100	1¾% quar. July 1
Egyptian Portland Cement Co. (common)[21]	Aug. 27	.....	16	18	40c quar. July 1
Egyptian Portland Cement Co. (warrants)[21]	Aug. 27	.....	10	20	
Giant Portland Cement Co. (common)[2]	Aug. 28	50	53	55	
Giant Portland Cement Co. (preferred)[26]	Aug. 28	50	54	60	3½% s.-a. June 15
Ideal Cement Co. (common)	Aug. 31	No par	71	73	1¾% quar. July 1
Ideal Cement Co. (preferred)[6]	Aug. 27	100	106½	109½	$1 quar. July 1
International Cement Corporation (common)	Aug. 31	No par	53½	54¾	$1 quar. Sept. 30
International Cement Corporation (preferred)[2]	Aug. 31	100	104⅛	104½	1¾% quar. Sept. 30
International Portland Cement Co., Ltd. (preferred)	Mar. 1	.....	30	45	
Kelley Island Lime and Transport Co.	Aug. 30	100	128	130	$2 quar. July 1
Lawrence Portland Cement Co.[2]	Aug. 30	100	100	110	2% quar.
Lehigh Portland Cement Co.[6]	Aug. 28	50	84	86	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1927 to 1931)[13]	Aug. 27	100	99	100	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1931 to 1935)[13]	Aug. 27	100	97½	99	
Marblehead Lime Co. (1st Mort. 7's)[14]	Aug. 28	100	104	106	
Marblehead Lime Co. (5½% notes)[14]	Aug. 28	100	98	100	
Michigan Limestone and Chemical Co. (common)[6]	Aug. 28	.....	25	.....	
Michigan Limestone and Chemical Co. (preferred)[6]	Aug. 28	.....	23½	25½	1¾% quar. July 15
Missouri Portland Cement Co.	Aug. 30	25	56¾	56¾	50c quar. Aug. 1, 25c ex. Aug. 1
Monolith Portland Cement Co. (common)[9]	Aug. 26	.....	11	11½	
Monolith Portland Cement Co. (units)[9]	Aug. 26	.....	27	28	
Monolith Portland Cement Co. (preferred)[9]	Aug. 26	.....	8	8¼	
Nazareth Cement Co.[29]	Aug. 27	No par	40	41	75c quar. Apr. 1
Newaygo Portland Cement Co.[1]	Aug. 30	.....	115	130	
New England Lime Co. (Series A, preferred)[22]	Aug. 28	100	95	100	
New England Lime Co. (Series B, preferred)[22]	Aug. 27	100	92	96	
New England Lime Co. (V.T.C.)[22]	Aug. 27	.....	35	38	
New England Lime Co. (6s, 1935)[14]	Aug. 28	100	99	101	
North American Cement Corp. 6½s 1940 (with warrants)	Aug. 31	100	97⅞	98	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[19]	Aug. 14	.....	94	99	2 mo. period at rate of 7%
North American Cement Corp. (common)[19]	Aug. 17	.....	20	22	
North American Cement Corp. (preferred)	Dec. 31	.....	.....	.....	1.75 quar. Aug. 1
North Shore Material Co. (1st Mort. 6's)[15]	Aug. 31	100	98½	100	
Pacific Portland Cement Co., Consolidated[5]	Aug. 27	100	71	73	½% mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	Aug. 27	100	.....	100	3% semi-annual Oct. 15
Peerless Portland Cement Co.[1]	Aug. 20	10	6¾	7⅜	
Petoskey Portland Cement Co.[1]	Aug. 31	10	9¼	9⅞	1½% quar.
Pittsfield Lime and Stone Co. (2 sh. pfd. and 1 com.)[10]	Aug. 28	.....	.....	225	
Rockland and Rockport Lime Corp. (1st preferred)[20]	Aug. 28	100	105	105	3½% semi-annual Aug. 2
Rockland and Rockport Lime Corp. (2nd preferred)[20]	Aug. 27	100	.....	.....	3% semi-annual Aug. 2
Rockland and Rockport Lime Corp. (common)[20]	Aug. 27	No par	50	50	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	Aug. 30	100	118	120	$2 quar. Apr. 1
Santa Cruz Portland Cement Co. (bonds)[5]	Aug. 27	.....	105⅞	.....	6% annual
Santa Cruz Portland Cement Co. (common)[5]	Aug. 27	50	80	.....	$1 quar. $1 ex. Dec. 24
Superior Portland Cement, Inc. (Class A)[30]	Aug. 26	.....	40	41	
Superior Portland Cement, Inc. (Class B)[30]	Aug. 26	.....	20½	21½	
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	July 16	100	98	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	July 16	100	96	99	
United States Gypsum Co. (common)	Aug. 30	20	159	160	2% quar., $1 ex. Sept. 1
United States Gypsum Co. (preferred)	Aug. 31	100	118	121	1¾% quar. Sept. 30
Universal Gypsum Co. (common)[3]	Aug. 31	No par	14½	15½	
Universal Gypsum V.T.C.[3]	Aug. 31	No par	14¼	15	
Universal Gypsum Co. (preferred)[3]	Aug. 31	.....	71	73½	1¾% quar. Sept. 15
Universal Gypsum Co. (1st Mortgage 7% bonds)[3]	Aug. 31	.....	99	(at 6½%)	
Union Rock Co. (7% serial gold bonds)[18]	Aug. 26	100	99	101	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[15]	Aug. 31	100	98½	100	
Wolverine Portland Cement Co.	Aug. 31	10	5	6	2% quar. Aug. 15

[1]Quotations by Watling, Lerchen & Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee, Higginson & Co., Boston and Chicago. [11]Nesbitt, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson Jr. Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25] A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York.

QUOTATIONS ON INACTIVE ROCK PRODUCTS CORPORATION SECURITIES ON PAGE 76

Editorial Comment

Two Cements or One?

At the meeting of the American Society for Testing Materials, held in Atlantic City last June, Cloyd M. Chapman advanced the idea that it might be necessary to have two kinds of portland cement. This was promptly opposed by Robert W. Lesley who remembered the confusion which existed when there was more than one specification for cement and who pointed out that much of the progress in the manufacture and use of cement has come from the adoption of a single, nationally accepted cement specification. Generally speaking, American engineers and contractors seem satisfied with a single grade of cement.

But the 28-day wait for concrete to harden sufficiently for construction to proceed has apparently become intolerable in certain kinds of construction, and it is for this reason that the demand for a quick-hardening portland cement has grown. In England and on the continent of Europe this demand has been supplied by special cements called "super-portlands" and sold under various trade names. Such cements cost considerably more to manufacture than standard portland cements and consequently sell at a higher price.

Concrete made from such cement hardens sufficiently to permit the removal of forms at the end of two or three days, or the opening of the roads to traffic in the same time in the case of concrete highways.

In the United States the demand for early high strength in concrete has been met in a different way. By studying the possibilities of standard portland cement it has been found possible to make concrete that will permit concrete highways to be opened to traffic in three days, and forms to be removed in the same time in the case of structures. The method calls for a little more cement, a slightly longer mixing time and (most important of all) a careful attention to the water-cement ratio of the concrete. The method has been widely popularized by the publicity work of the Universal Portland Cement Co. and lately by the Portland Cement Association. It is no longer experimental and it is perfectly safe if it is applied by competent men.

And at the same time the quality of portland cement in the United States has been constantly improving, as was shown by the survey made by the A. S. T. M. cement committee during the past year. This improvement is still proceeding so that certain brands now develop three-day strengths that would have been considered impossible for standard portland cement a few years ago. The betterment in quality has been made with no added cost to the user of cement, for the product sells for the same price as it did before.

With a constantly bettering quality of portland cement, and better methods of making it into concrete, it seems that every reasonable demand for early high-strength concrete may be satisfied by so-called "standard" portland cement. Competition between manufacturers for the reputation and quality of their brands may easily result in making what are known as "super cements" in Europe "standard" cement in the United States a few years hence. Our engineering industries and professions are apparently too thoroughly sold on the advantage of standards generally to return to the day of specialties.

Agricultural Limestone

Writing in the *Crushed Stone Journal* A. T. Goldbeck speaks of agricultural limestone as offering a great, important and undeveloped market. How great, how important and how undeveloped it is one does not realize until he studies a little geography and the causes that affect the increase and decline of population.

Recent studies have shown that calcium played a larger part in body chemistry than had been supposed and emphasized the importance of calcium in the diet. This explains why soils containing limestone have been selected by instinct for human habitation and for raising domestic animals.

Fortunately the virtues of limestone in the soil have not been confined to limestone areas. The rivers have long taken limestone from bluffs and deposited it in valleys at flood times the world over. The wind has blown it from river bars over considerable areas. As an example of this one may note the loess soils along the Missouri river which are very fertile, and which have a high available lime content. Similar soils have been cultivated for centuries in China. The glaciers have ground up a great deal of limestone and spread it throughout the glaciated areas of the world. Through such agencies it has come about that much of the land has been improved for human habitation by the addition of limestone.

In using agricultural limestone men are using truck and rail transportation to do what the rivers, the winds and the glaciers have done and to do it more quickly and efficiently. The movement of limestone by artificial means is most marked at present in states which were not at all deficient in limestone but in which the available lime seems to have been somewhat lessened by repeated cropping, especially with such crops as alfalfa. In other words the most agricultural limestone is used where the virtues of limestone are best known. But as the demand for food and the price of agricultural products rise the use of agricultural limestone will increase, and presumably in much greater proportion, because it will be more widely used in other states.

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Dividend rate
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	.....	12½	.....	
Coplay Cement Mfg. Co. (preferred) (4)	Dec. 30	.....	70	.....	
Eastern Brick Corp. 7% cu. pfd.) (1)	Dec. 9	10	40c	.....	
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c	.....	
Edison Portland Cement Co. (common)	Nov. 3	50	7½c(x)	.....	
Iroquois Sand & Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1)	Mar. 17	.....	$12 for the lot	.....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	.....	
Lime and Stone Products Co. (1100 sh. pfd., $10 par and 700 sh. com., $10 par)	Feb. 10	.....	$66 for the lot	.....	
Missouri Portland Cement Co. (serial bonds)	Dec. 31	.....	104¾	104¾	3¼ % semi-annua.
Olympic Portland Cement Co. (g)	Oct. 13	.....	.....	£1⅛	
Phosphate Mining Co. (1)	Nov. 25	.....	1@5	.....	
River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.) (1)	June 23	.....	$200 for the lot		
Rockport Granite Co. (1st 6's, 1934) 2	Aug. 31	.....	90	.....	
Simbroco Stone Co. (pfd.)	Dec. ..	.....	.....	.....	$2 Jan. 1
Vermont Milling Products Co. (slate granules) 5 sh. pfd. and 1 sh. com. (3)	Dec. 30	.....	$1 for the lot	.....	
Wabash Portland Cement Co.1	Aug. 3	50	60	100	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16	.....	10c	.....	

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925.

Federal Portland Bonds Offered

MANUFACTURERS AND TRADERS TRUST CO., Buffalo; Howe, Snow & Bertles, Inc., Detroit; O'Brian, Potter & Co., Baker, Trubee & Putnam, Inc., and Vietor, Common & Co., Inc., Buffalo, are offering at 100 and interest $800,000 first mortgage 6½% gold bonds. Guaranteed as to principal and interest by the Buffalo Slag Co. and the Standard Slag Co. Dated September 1, 1926; due September 1, 1941. Redeemable on any interest date, all or part, by lot upon 60 days notice at 105.

The following data are from a letter of L. A. Beeghly, president of the company:

Company.—Has been organized by Buffalo (N. Y.) Slag Co., Inc., and the Standard Slag Co., Youngstown, O., and is erecting on a site of 45 acres adjacent to the Lackawanna plant of the Bethlehem Iron & Steel Corp. a modern portland cement mill with an annual capacity of 1,000 000 bbl. It is expected that production will commence on or before March 1, 1927. It is estimated that the annual consumption of cement in the Buffalo territory is in excess of 2,000,000 bbl.

Capitalization.—	Authorized	Outstanding
1st mtge. gold bonds, 6½ %..	$ 800,000	$800,000
7% cum. pfd. stk. (par $100)..	1,000,000	860,000
Common stk. (no par), shares	20,000	20,000

Purpose.—The mortgage provides that the entire net proceeds of this issue will be deposited with the trustee, which will advance these funds to the company only after an amount of $880,000 (which has already been obtained through the sale of securities junior to these bonds) has been previously expended for property and plant upon which these bonds are a first mortgage. Proceeds from the sale of this issue will be used for the construction of plant, purchase of equipment and for other corporate purposes.

Earnings.—Based on present prices and careful estimates of selling and administrative costs, annual net earnings of the company available for interest on these bonds, it is estimated, will be in excess of $400,000, or over 8 times interest requirements of this issue. Thus net earnings of the company together with those of the guarantor companies are estimated in excess of 14½ times interest charges on these bonds.

Sinking Fund.—Commencing September 1, 1927, and semi-annually thereafter, the company will pay to the trustee as a sinking fund for the retirement of bonds, sums based upon the amount of cement sold by the company during each preceding 6 months' period: viz., until March 1, 1930, at the rate of 5 cents per barrel; thereafter until March 1, 1933, at the rate of 8 cents per barrel; thereafter until maturity, at the rate of 10 cents per barrel.

Management.—Management of the Federal Portland Cement Co., Inc., is in the hands of men who have engaged for years in the slag and cement industries and who have a thorough knowledge of and experience in the manufacture and sale of portland cement. Officers are L. A. Beeghly, president; W. E. Bliss, vice-president; H. N. Snyder, secretary-treasurer, and J. G. Harding, general manager.

Rockland-Rockport Earnings

THE gross income of the Rockland and Rockport Lime Corp. for the 6 months ended June 30, 1926, was $924,545, as compared with $832,147 for the same period in 1925, and represents an increase of about 11%. Net profit after deductions for taxes, depreciation, etc., was $89,265, against $51,941 in 1925, an increase of 73%. The company has recently secured a contract to supply what has hitherto been waste limestone to the Mystic Iron Works of Massachusetts.

Schumacher Preferred Offered

HUNTER, DULIN AND CO., Schwabacher and Co. and Cass, Howard and Sanford, Inc., San Francisco, are offering at $26 per share and dividends, to yield about 7.70%, 30,000 shares participating preferred stock (no par value) with full voting privilege of the Schumacher Wall Board Corp.

Cumulative as to dividends of $2 per share per annum. After dividends of $2 per share on the participating preferred stock and $2 per share on the common stock have been paid in any one year, the participating preferred stock shares equally with the common stock, share and share alike, in any further dividends paid. Shares are fully paid and non-assessable. Callable at $30 per share and dividends at any dividend date on 60 days notice.

Capitalization—	Authorized	To be issued
Cumulative participating preferred shares (no par)	30,000 shares	30,000 shares
Common shares (no par)	60,000 shares	60,000 shares

The following data are from a letter of A. R. Moylan, executive vice president of corporation:

Business.—Business was established in 1913 for the manufacture and sale of plaster board and kindred products used in building construction. It has grown to be the largest manufacturer of plaster board west of the Rocky Mountains and owns and operates large plants in Los Angeles, Calif., and Seattle, Wash. District sales offices are maintained in San Francisco, Seattle and Portland, and warehouses in San Francisco, Oakland, San Rafael, San Jose, Stockton, Tacoma, Portland, Seattle, San Diego and Sacramento. During its 13 years of operation it has never had an unprofitable year and each year sales have shown a consistent increase over those of the preceding year.

Common Stock Purchase Privilege.—During this offering the purchasers of the participating preferred stock will be entitled to buy at $17 per share, one share of common stock in the form of voting trust certificate for every three shares of participating preferred stock purchased. After payment of $2 in dividends on the participating preferred stock, the net earnings available for dividends on the common stock have averaged $138,220 for the past five years. This is equivalent to $2.30 per share, or 13.50% on the purchase price of $17 per share.

Management.—The present personnel, to which the past success of this company is largely due, will be maintained, and the alliance of this successful organization with the Paraffins Cos., Inc., and strong financial interests will provide an even sounder basis for future development and profits.

The Paraffine Cos., Inc., and strong financial interests have become interested in the management and success of Schumacher Wall Board Corp. through the acquisition by them of a majority of the common stock of the Schumacher Wall Board Corp. Arrangements have been made whereby A. R. Moylan, who has been associated in an executive capacity with the Paraffine Cos., Inc., for the past 11 years, is to become executive vice president and general manager of the company, and the board of directors of the Schumacher Wall Board Corp. will include R. S. Shainwald, vice president and general manager of the Paraffine Cos., Inc., and others identified with the banking interests and the Paraffine Cos.

Earnings.—Net sales and earnings for the past five years, after all charges, including depreciation and Federal income taxes, adjusted by the elimination of nonrecurring charges and the operating loss of Seattle branch for 1925 of $19,526, and after giving effect to the acquisition of patents and license contracts as reported by Peat, Marwick, Mitchell & Co., have been as follows:

NET SALES AND EARNINGS OF SCHUMACHER WALL BOARD CORP.

	1922	1923	1924	1925
Net sales	$833,305	$1,175,985	$1,186,132	$1,277,540
Operating profit before depreciation, depletion and Federal taxes	222,202	231,334	259,860	250,355
Net profits	170,237	175,949	197,985	198,203
Times preferred dividend earned	2.84	2.93	3.29	3.30

Trinity Portland to Build 4-Kiln Plant at Houston

PLANS for one of the most modern cement plants in the south, to be located at Houston, Texas, and to cost $2,000,000, have been completed by officials of the Trinity Portland Cement Co. of Dallas, Texas, and construction is to start shortly. It will be located at the Buffalo Bayou, just outside of Houston at North York street.

A 17-acre site has been purchased for a consideration of $60,000, which will constitute the plant site only, according to O. B. Barthomolew of Dallas, who will be general superintendent of the plant when it is completed. This site has been cleared and temporary offices of the construction forces have been erected.

Five large buildings and a number of smaller ones will be constructed on the site. The plant will have initial capacity of about 1700 bbl. which will be later raised to 7000.

The largest of the structures will be the storage and grinding rooms. The building will be 100 ft. wide, 625 ft. long and 100 ft. high. It will be divided into clinker storage, 100x125 ft.; grinding room, 165x 100 ft., and clay and shell storage room, 100x350 ft. A 1-yd. bucket on a traveling crane will serve the building. Its lifting capacity will be approximately seven tons. The packing house will be 50x70 ft. Eight silos, each 34 ft. in diameter and 100 ft. high, with a total storage capacity of 176,000 bbl., will be erected.

Four kilns, each 300 ft. long by 11.3 ft. in diameter, and a 250-ft. smoke stack will be installed. Shells will be dredged and brought to the plant by barges. The barges will dock at a wharf 600 ft. long to be built along the bayou.

One of the first units to be erected will be the machine shop, 40x227 ft., which will contain the stock room. The other smaller units of the plant will include general offices, laboratory and change houses. Four railway tracks, each about 1400 ft. in length, and about a half mile of concrete streets will be laid. Other equipment will include cranes and conveyors.

Approximately 45 men will be placed at work on the project at once under the supervision of W. B. Stegman, construction superintendent.

This will make four plants in the United States using oyster shells as raw material for making portland cement. Two of these, the Texas Portland Cement Co. and the Redwood City, Calif., plant of the Pacific Portland Cement Consolidated have been in operation for some time. A third is the plant of the International Cement Corp. now building at New Orleans.

The Trinity company recently completed and put in operation a single kiln wet-process plant at Fort Worth, Texas. This was described in the November 28, 1925, issue of Rock Products. Another plant, a 5-kiln dry process plant, is in operation at Dallas, Texas. The officers of the company are: W. H. L. McCourtee, president; E. C. Ulrickson, vice-president and general manager; F. G. Ray, secretary; M. J. Scanlan, treasurer. O. V. Bartholomew is superintendent of the Dallas plant and A. A. Chaney superintendent of the Ft. Worth plant.

Warrior Cement Building New Plant

THE Warrior Cement Corp. has a rather large expansion program under way, according to a statement made by C. S. Steward, treasurer of the company. The company has been operating the old plant established by the Gulf State Co., and is now building a new plant which will be up-to-date with modern machinery and better equipment. It is expected that the new plant will be finished by December.

Two new kilns 10x150 ft., equal in size to the kilns in place, are being installed. A new warehouse is also in process of construction at New Orleans.

The Warrior company was organized a little more than a year ago and took over the holdings of the Gulf State Portland Cement Co., located near Demopolis, Ala., on the Black Warrior River. The company has bought a coal mine up the river near Cordova, Ala., and ships the coal down by barge or boat to the plant.

The Demopolis plant is a dry process 2-kiln operation and last year produced about 500,000 bbl. The company expects that the annual capacity after additions of the two kilns will be increased to 1,000,000 bbl.—*Chattanooga (Tenn.) News.*

Union Rock to Open New Bunkers at Wilmington

THE new storage bunkers at Wilmington, Calif., recently completed at a cost of $35,000 by the Union Rock Co., Los Angeles, will soon be put into use. Work was started early last May on these bunkers which are of frame and concrete, 100 ft. high and 42x106 ft. An office building, one-story frame, 16x20 ft., has already been erected. A spur track has been built which allows the cars to go into the plant for loading and unloading.

The dumping pit for the rock, sand and gravel is 27 ft. deep. From the pit the material is elevated to the 12 storage compartments which have a total capacity of about 4000 tons. This storage is one of the 28 that the Union Rock Co. has at various points in Los Angeles and surrounding territory and which are part of the efficient distribution system of the company. The source of supply for the new bunkers is located at San Fernando, Wash.—*Wilmington (Calif.) Journal.*

Alfonso de Navarro

ALFONSO DE NAVARRO, vice president of the Atlas Portland Cement Co., and a member of a family long prominent, died suddenly of apoplexy, Sunday, August 15, at the private shooting lodge of George F. Baker, Jr., at Brechin, Scotland.

Mr. de Navarro had been in Europe about a month. He had been shooting at the lodge on the Thursday and Friday previous to his death, and on Sunday afternoon took a motor ride. Leaving the car a mile and a half from the lodge, he walked to it, arriving among a group of friends in the best of spirits and apparently in perfect health. He sat down in a chair and a moment later expired.

Mr. de Navarro's body was taken to London by Mr. Baker and other friends and given into the keeping of his brother, Antonio de Navarro, and the latter's wife, the former Mary Anderson, who have lived for many years on their estate at Broadway in Worcestershire, England.

Mr. de Navarro was born in New York City in 1863. He was a bachelor and lived at 15 East 48th Street. His father was Jose F. de Navarro, for some time Spanish consul general in this city, and active in the upbuilding of the city in the last quarter of the past century. In 1886 Jose F. de Navarro and his two sons, Antonio and Alfonso de Navarro, erected in the United States the first rotary cylinder for the burning and manufacture of cement. This cylinder was erected under patents taken out by Henry Mathey, which were controlled by the de Navarro family. They continued their experiments and within a few years had completely revolutionized the process for the manufacture of portland cement and the use of the rotary kiln became universal. Mr. Alfonso de Navarro had been a vice-president of the Atlas company since its inception.

Mr. Alfonso de Navarro was a trustee of the Equitable Life Assurance Society and also a trustee of St. Patrick's Cathedral, where funeral services will be held at some later date not yet fixed. Mr. de Navarro was a graduate of Columbia Law School and had been admitted to the bar. He was a member of many prominent clubs.

Alabama Company To Build Lime Plant at Colera

ACCORDING to recent announcement, the Alabama Lime and Stone Corp. have completed plans for the installation of new kilns and a hydrating unit in a new plant to the built at Colera, Ala. Contract for the kilns and hydrator has been awarded the Schaffer Engineering Co., Pitstburgh.

The crushing plant at Gate City, near Birmingham, is now being dismantled. This was formerly operated by the McDonough Ore and Mining Co. and was included in the consolidation of that company with the Alabama Lime and Stone Corp. In addition to the new lime plant, a modern crushing plant will be run in conjunction.

Fire Damages Weston and Brooker Quarry Buildings

A FIRE, believed to have been started by an electric motor, destroyed the main building of the Weston and Brooker quarry at Cayce, a few miles from Columbia, S. C., on August 18, and caused a loss of about $90,000. The crusher and other buildings, valued at considerably more than $100,000, were saved by the firemen. About one-fourth of the loss was covered by insurance.

Work on rebuilding the structure will begin immediately, first steps for reconstruction being taken on the night of the fire. For two months workers will be busily engaged getting material in place, and during that time the plant will be closed and no quarrying will be done.

The company, of which T. I. Weston is president and W. S. Weston is manager, employs 150 men. The building destroyed by the flames was erected in 1906 and was of unusually heavy timber construction.

The Weston and Brooker quarry is one of the largest and best known in the Southeastern states, and has been of great importance in the past two or three years because it furnished so much crushed rock to supply the heavy demand from Florida and other parts of the Gulf coast. As a quarry operation it is unusual and interesting.

The rock is a bluish granite and the quarry face is 212 ft. deep at the deepest part. A portion of the quarry floor is 177 ft. below the bed of the river that flows beside the quarry and 100 ft. below sea level.

The quarry has been worked in two pits forming a V, but the portion between the two was shot out, making both pits into a single quarry in 1924. (See Rock Products, Oct. 18, 1924, for a description by H. O. Lindler, foreman, of the method of taking out the V by shots with "zig-zag" loading). The stone is hoisted from the quarries by Lambert electrically driven hoisting engines in traveling towers with main cables 2½ in. diam. stretched across the pits. Pans holding 5 tons of stone are hoisted from the bottom and carried to the crushers by travelers running on three cables. A detailed description of the plant and quarry was published in Rock Products for July 28, 1923.

Quarry and plant of the Weston and Brooker Co. at Cayce, S. C.

Building which was damaged by fire

Consolidated Rock Products Plant Begins Production

THE new $300,000 rock plant of the Consolidated Rock Products Co. at Brooksville, Fla., was placed in operation recently. The capacity of about 2000 tons per day of crushed limestone goes almost entirely into construction work.

The Consolidated Rock Products Co. was recently organized by W. P. McDonald of the W. P. McDonald Construction Co., New York. Besides the Brooksville plant, the company has under construction a plant in Sumter county which is expected to start production within a short time. The capacity of this plant, it is stated, is about 1800 tons per day. Financial details concerning these two plants were published in the August 7 issue of Rock Products.

Bichler Bros. to Erect New Plant

BICHLER Bros. Stone and Gravel Co., of Escanaba, Mich., have closed negotiations for a long-term lease from the I. Stephenson Co. of a large gravel pit, located on the Soo Hill road, west of the Soo Line tracks and will immediately begin the construction on the property of one of the largest and most complete crushing and washing plants in the upper peninsula.

The Bichler Brothers' gravel crushing and washing plant at Grove was destroyed by fire early this spring and negotiations have been pending for several months for the location of the new plant that has now been secured.

Representatives of Milwaukee designers and engineers have been in Escanaba recently preparing plans and specifications for the proposed plant and the contract for its construction will be awarded within a short time.—*Marinette (Wis.) Eagle-Star.*

National Gypsum to Build Plant at Grand Rapids

THE National Gypsum Co. of Buffalo and Chicago has purchased property or secured mineral rights on a royalty basis on a total of about 160 acres located about three miles from Grand Rapids, Mich., and proposes to develop the same in the immediate future, according to announcements made in the *Grand Rapids (Mich.) Herald.*

Included in the property for which negotiations have been opened are several gravel pits, among them the Kent Sand and Gravel Co. and H. Zeef and Son. Some details are said to be still pending.

It is said that the National company will erect a modern mill and undertake the mining and manufacturing of gypsum products on a large scale. A spur line connecting with the New York Central railroad and giving rail outlet is planned, although as far as local officials of the railway were informed, arrangements for this trackage had not been completed.

The advent of the National Gypsum Co. in the local field gives Grand Rapids six corporations engaged in mining and manufacturing this product. The five other companies operate 10 mills. They are the Certainteed Products Corp., which has expended approximately $1,500,000 on its Beverly properties in the last four years; the Michigan Gypsum Co. with which is affiliated the Alabastine Co., the Grand Rapids Plaster Co., the Beaver Products Co., Inc., and the United States Gypsum Co. The Grand Rapids Plaster Co. operates three mills, the Beaver Products Co. and the United States Gypsum Co. two mills each.

The National Gypsum Co. was established a short time ago and has one mill near Buffalo, N. Y., in operation. The proposed new mill at Grand Rapids is in keeping with the expansion plans of the company which include other plants in different cities. J. F. Haggerty is president and secretary of the company, C. E. Williams is vice-president and treasurer. Offices are at 415 Jackson building, Buffalo.

Fairmont Company to Pulverize Limestone

THE Fairmont Limestone and Sand Co. is opening a plant half a mile beyond Farmington, W. Va., to supply crushed stone for road building, pulverized limestone for agricultural purposes, and triturated limestone for rock dusting mines.

The company has 40 acres of limestone 12 ft. thick which it will develop. A crusher with a daily capacity of 125 tons has been installed to crush stone for road construction and a pulverizer with a daily capacity of 25 tons for comminuting limestone has been installed, and within a short time a Griffin mill with a capacity of 30 tons a day, to prepare limestone for rock dusting mines, will be put in place. The company has erected a bin that will hold 325 tons of crushed stone for road material and also has storage for the pulverized product.

A 50-ft. vein of sand runs through the deposit and this will be worked. The plant will be operated by steam, the coal for fuel being readily obtainable from the deposit. It is expected that all the products will find a good market within the locality.

George B. Morgan is president and general manager of the company; D. A. Pigott, vice president, and E. N. Eddy, secretary treasurer. — *Fairmont (W. Va.) Times.*

Cement and Quarry Men to Address Safety Congress

IT is expected that scores of plant leaders will attend the special sessions held especially for men in the cement industry in conjunction with the 15th annual safety congress at Detroit from October 25 to 29, inclusive. H. G. Jacobsen, in charge of the accident prevention program of the Portland Cement Association, who is arranging the program for the coming convention, will have the leaders explain how they have been able to make remarkable records during the past year. The sessions will be open to both members and non-members.

Among the speakers who are scheduled to deliver addresses are:

G. S. Brown, president of the Alpha Portland Cement Co., Easton, Penn., who will tell how executives regard the efforts to reduce accidents in the industry.

Eugene T. Green, manager of the insurance and personnel department of the Riverside Portland Cement Co., Los Angeles, Calif., who will discuss "The Relationship Between the Physical Examination and Accident Prevention."

Edward H. Parry of the Glens Falls Portland Cement Co., Glens Falls, N. Y., whose subject will be "A Year's Experience with a Borrowed Plan."

The safe handling of explosives will be discussed at the sessions held especially for the quarry industries and which will be in charge of E. E. Evans, president of the Whitehouse Stone Co., Toledo, Ohio. Both members and non-members of the National Safety Council will be welcome.

A joint meeting of the Cement and Quarry Sections will be held on Wednesday, October 27. There will be a luncheon in the Book-Cadillac hotel and a session at which there will be a round table discussion of the following subjects:

"How to Protect Workmen with Regard to Storage Bins."

"Protecting the Individual Versus Guarding Machinery in a Stone Crushing Plant."

"Advantage of Inspection Trips to All Operators."

Rock Products Demand Heavy Throughout Chicago Territory

ROCK PRODUCTS continued to move in heavy volume from the producing plants in Chicago territory into all trade channels. The month closed with the quarry interests operating at capacity and no indication of a slowing down in carload shipment tonnage for some time to come. It has been a month of heavy production, heavy shipments and a satisfactory situation as to the volume of orders, although prices have held at about the same levels of the previous 30-day period.

A steady demand was reported for crushed stone for ordinary building purposes, such as the mixing of concrete, and there was a picking up in the call for agricultural limestone from the country yard trade. The railroads were still taking ballast stone in heavy volume, and they also were urging rush shipments on orders for limestone screenings wanted for use as top dressing on their right-of-way improvements. The week opened with the asphalt plants in the market for binder stone and ground limestone for mixing purposes, and some of the quarries were making heavy shipments of stone for road work into Indiana and Michigan territory.

The market for sand and gravel also was active. Shipments of bank sand from Dune Park and other loading points in the Michigan City district were heavy to the railroads for track elevation work. The railroads also were wanting shipments on locomotive sand, and inquiries were numerous for fine sand used in core making by the foundry trade. Torpedo sand demand shows no slackening, due to the activity in caisson work. The outlook in the market for rough materials was for more staple prices with the approach of the fall season.—*Chicago Journal of Commerce.*

Four Lost When Sand Carrier Sinks in Lake Erie

THE sand carrier Harold S. Gerken, listed out of Buffalo, was sunk recently during the 50-mile gale that swept Lake Erie on August 21. The ship, battered by the heavy waves, sprung a leak and rapidly began to sink, and the crew took to the lifeboats. Out of the crew of 20, 16 were rescued by the passing *S. S. Maitland,* but the other four men in another lifeboat are still reported to be missing.

The Harold S. Gerken was formerly the freighter Phelan and was converted to a sand carrier for service between lake parts by the present owner, H. S. Gerken of Buffalo, N. Y. When caught in the storm, the carrier was bound for Buffalo with a load of sand from the Erie peninsula. J. B. Gamble was the captain.—*Buffalo (N. Y.) News.*

Foreign Abstracts and Patent Review

Composition of Magnesium Oxychloride Cement. A study was made for the purpose of determining the properties of magnesium oxychloride cement, particularly with respect to its setting and hardening properties. The composition of this cement was investigated at a temperature of 50 deg. C. for the system $MgO{\cdot}MgCl{\cdot}H_2O$. In order to determine this equilibrium, the authors devised a new apparatus for measuring the solubility and also made an improvement in the electrical regulation of the thermostats. In the aforementioned system $MgO{\cdot}H_2O$, $3MgO{\cdot}MgCl_2{\cdot}12H_2O$ and $MgCl_2{\cdot}6H_2O$ are found as solid phases at a temperature varying between 25 and 50 deg. C. The principal characteristics of this system at a temperature of 50 deg. are as follows:

Solid phases	Per cent $MgCl_2$ in solution
$MgO{\cdot}H_2O$, $3MgO{\cdot}MgCl_2{\cdot}12H_2O$	14.01
$3MgO{\cdot}MgCl_2{\cdot}12H_2O$, $MgCl_2{\cdot}6H_2O$	37.00

From this stable equilibrium there arises another unstable equilibrium for $MgO{\cdot}H_2O$ at least in a solution of 14.01 to 20.95% $MgCl_2$ and for $3MgO{\cdot}MgCl_2{\cdot}12H_2O$ at least in a solution of 12.45 to 14.01% $MgCl_2$. The composition of the magnesium oxychloride cement is discussed for only three cases at a point of equilibrium, and a formula of the composition was calculated in just one case. The composition of the ordinary cement is $3MgO{\cdot}MgCl_2{\cdot}12H_2O$, $MgO{\cdot}H_2O$. The proportion of the double salt is constant, at about 57.8 to 61.8%, while the proportions of the other constituents vary. *Sci. Papers Inst. Phys. Chem.*, **4** (1926), 85-101.

Ferruginous and Aluminous Cements. Ferruginous cements, consisting mainly of calcium ferrites, $2Fe_2O_3{\cdot}nCaO$, in which n is equal to 5, 6 or 7, are obtained by heating the raw materials, lime and pyrites cinder together below the fusion temperature. These cements set slowly but are very resistant to attack by water which contains sulphates and alkalies. Ferro-aluminous cements, which consist of mixtures of calcium ferrites, aluminates and ferro-aluminates, are made in a similar manner. By varying the proportions of ferric oxide or alumina, the rate of setting and also of hardening can be varied within wide limits. All the cements are very resistant to the attack of sulphates and are suitable for reinforced concrete work in sea water.

Catalytic Action of Cement or Clinker in Crystallizing Lime. It is claimed that the lime hydrate crystallizes as such only in the presence of clinker or cement sediments (contact substances). Hence the lime hydrate was found in crystalline form only in solutions which were made with clinker or cement. These crystals were found on the walls of flasks in which hydration tests were carried out and on samples which were being used for strength determinations under water. The presence of undecomposed "mother-substance" seems also to be a condition for the formation of crystals. The following tests were made and are recommended for clearing up this question:

A few pieces of clinker or a quantity of cement is placed in a large beaker and distilled water is poured over the solid. The mixture is well stirred and then allowed to remain at rest. After a few days have elapsed the characteristic crystals of lime hydrate appear on the deposited substance and on the bottom and walls of the beaker. As soon as a considerable formation of crystals has taken place, an aliquot portion of the solution is titrated to determine the lime content.

Then approximately one liter of the solution is filtered or carefully pipetted out of the large beaker into a flask and the solution is then evaporated, or rather concentrated to one-third or one-fourth of its original volume without the use of heat under a vacuum and with exclusion of all air carbon dioxide. Even after repeating this operation three or four times there was no evidence of any crystallization of lime hydrate despite the high concentration of the solution.

Another test was made with caustic lime and slaked lime (powdered lime hydrate) as the starting materials in the experiment. These were stirred with water and the solution titrated from time to time to determine the lime content. After a period of three or four weeks had elapsed the lime content of the solution increased to several times that of the solution which formed lime hydrate crystals. These had been obtained by allowing the lime to remain in contact with clinker. But the first solution when examined under the microscope gave no evidence of any crystallization of lime hydrate.

A prolonged test of two full years made on such a solution gave no indication whatsoever of the formation of crystals of lime hydrate. It has been held that this must have been a supersaturated solution, but nevertheless no separation of lime hydrate crystals took place, as might have been expected. The solution had plenty of opportunity to decompose the deposited substance and to become supersaturated and to deposit the excess lime hydrate in the form of crystals. But this did not take place. However, when an aliquot proportion of this solution was pipetted out into a separate flask and several pieces of clinker or a few grams of cement were added to the solution, lime hydrate crystals formed at once. Air had to be excluded from the apparatus in these tests for the reason that the carbon dioxide coming in contact with the lime hydrate would form lime carbonate and spoil the test.

The net conclusion reached was that the clinker or cement acts as a contact catalyst in the crystallization of the lime and the excess lime in cement is therefore crystallized. *Zement* (1926), 513.

Artificial Gypsum Stone. Dolomite is acted upon by sulfur dioxide gas and the product obtained mixed with gypsum to give an artificial stone. *German Patent* No. 426,760.

Polished and Translucent Cement Surfaces. Special aluminous cements, containing less than 1½% of iron, and composed essentially of monocalcium aluminate, are used in contact with polished molds to form articles which have a polished and somewhat translucent surface. This surface may be colored or decorated. *British Patent No. 234,846.*

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.

Cement of Iron and Alumina Combination. Process using limestone, iron pyrite cinders from sulfuric acid manufacture, or iron ores and residuals of aluminum manufacture, bauxite, etc., to produce hydraulic cement. The burning is carried on at a temperature of from 1100 to 1300 deg. C. or below the melting point of the mixture. *U. S. Patent No.* 1,586,099.

Lightweight Gypsum Plaster and Block. Composition consisting of plaster-of-Paris, powdered or granulated cork, fibre and zinc sulphite for making lightweight, soundproof, etc., plaster and block for building purposes. *U. S. Patent No.* 1,585,743.

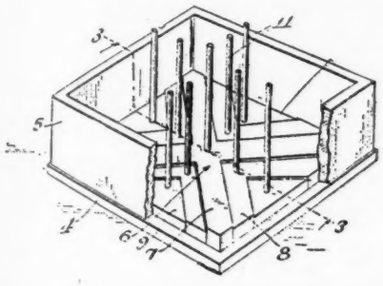
Plastic Composition. Plaster made of calcined magnesite, disintegrated rock, calcite, sawdust, magnesium chloride and coloring agent such as ochre, etc. *U. S. Patent No.* 1,586,045.

Alumina Cement. Process for manufacture of alumina cement by the fusion of mixtures of materials containing alumina, iron, silica and lime in the presence of sufficient free carbon to form ferro-silicon. *U. S. Patent No.* 1,591,662.

Refractory and Insulating Cement. Mineral wool rock (siliceous limestone) is calcined at about 1200 deg. F. and crushed, and to this is added mineral wool, filler such as asbestos, siliceous limestone and mineral wool gum (siliceous limestone dissolved in dilute solution of H_2So_4). By addition of water a refractory and insulating cement is produced. *U. S. Patent No.* 1,591,676.

Producing and Seasoning Hydrated Lime. Lump-lime as drawn from the kilns is placed in special screen-bottomed cars and the cars and contents dipped in water. The excess water is drained off through the screen bottom and the hydrate carried in the car to either an air separator or conveyor leading to storage. *U. S. Patent No.* 1,536,670.

Method and Mold for Making Art Tile. A design is built up face down of stencil blocks, face down in a mold, which are fitted closely together. Certain parts of the blocks are removed and the space vacated and filled with cement inserted downward and other blocks removed upwards and the foregoing



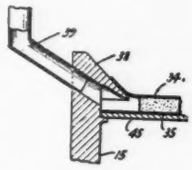
procedure with the cement continued and then allowing the different cements to set into a unitary tile. *U. S. Patent No. 1,597,373.*

Process for Manufacture of Artificial Marble. Chalk, portland cement, pigment and sufficient water to make a plastic mass are mixed together and then molded to a desired form. After hardening, the molded material is successively polished with a fluoride solution and a water glass solution. *U. S. Patent No. 1,597,103.*

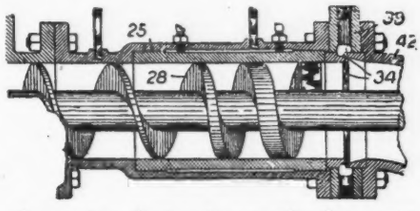
Using Waste Heat from Cement Manufacture. The combination of steam-heated low-temperature fuel-carbonization still or retort, a cement kiln, a steam-generating plant, means to convey exhaust gases from the cement kiln to the steam-plant for heating the same, means to pass steam therefrom to the still or retort to supply heat thereto, means for feeding into the kiln pulverized coke residue from the still or retort for firing the kiln therewith, means associated with the steam-plant for burning gas obtained from the still or retort to assist in the heat of said steam-plant, and apparatus for treating said gas and recovering the by-products obtained from the carbonization of the fuel in the still or retort before gas is supplied to the steam-plant. *U. S. Patent No. 1,596,956.*

Lime Kiln Fired with Pulverized Fuel. Arrangement of construction by which standard upright kilns can be fired with pulverized fuel and produce lime of good grade. *U. S. Patent No.* 1,586,318.

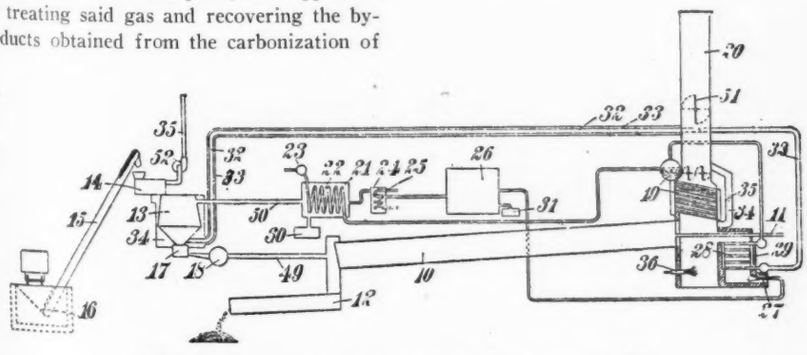
Fabrication of Plaster Board. A method of making plaster board having a body and upper and lower cover sheets by which the cementitious material is interposed between the sheets so as to leave an unfilled edge margin. The edge margin of the upper sheet is lifted and another plastic mass introduced to fill the margin. *U. S. Patent No. 1,597,623.*



Seasoning Portland Cements. The hydration and carbonation of the free lime in portland cement is effected by subjecting the ground cement to mechanical pressure in a pipe line and injecting air or gas under pressure into it, the mixture of gas and cement being thus caused to flow along the pipe to storage bins, etc. A gas rich in moisture and carbon dioxide is more effective than air, and the kiln gases may be used for the purpose after moistening or partly drying them if necessary. In one method of carrying out the process the cement is fed into a hopper and compacted in a conduit 25 by means of a differential screw 28. Gas under pressure is admitted at the further end of the conduit from an annulus 39 provided with a number of forwardly directed orifices 34, causing the cement to flow along the pipe line 42. *J. W. Fuller, Catasauqua, Penn. British Patent No. 250,599.*



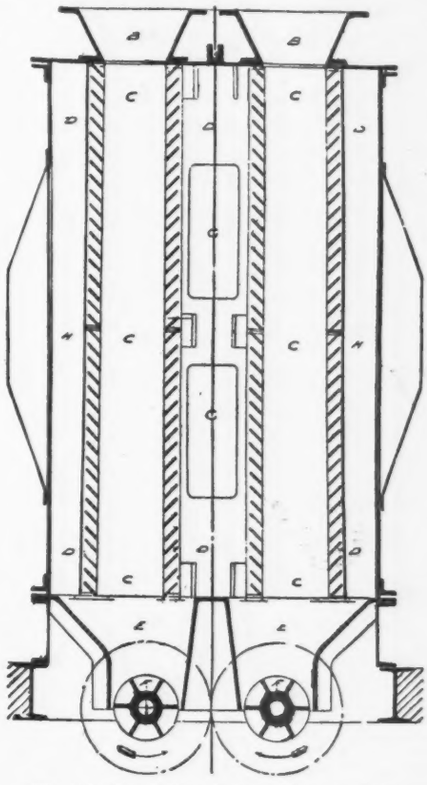
Seasoning device for portland cement



Efficient utilization of waste heat from cement kiln

Vertical Gravity Dryer

A BRITISH invention called the "F. E. Patent Vertical Gravity Dryer" has been placed on the market by the Fuel Engineering Co. of London. It would seem to be well adapted to the drying of such coarse materials as cement rock, crushed stone, gravel and crushed slag.



Vertical gravity dryers for coarse materials

The material is fed in from the hoppers marked A in the cut. The columns C, C, are kept full of the material to be dried. The hot air or waste flue gas used to dry the material is admitted in the center chamber C and passes horizontally through the lower grids O and through the material to the chambers H at the side. The dried material is slowly drawn off at the bottom by the rotary discharge valve shown at F. The illustration is from the British *Stone Trades Journal.*

Compressed Air from Descending Quarry Cars

AT the Nidderdale water scheme in Yorkshire, England, a quarry for producing crushed stone to be used as aggregate has been established 800 ft. above the dam. The cars of stone going down generate an excess of power over that required to empty the cars. According to the London *Contract Journal* the engineers in charge have found a way to use this excess power in compressing air which is used in the quarry. The dam to be built is 1800 ft. long, 230 ft. high and 135 ft. thick at the base, so the quantity of stone required justifies the expenditure for power saving.

Traffic and Transportation

EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning August 30:

CENTRAL FREIGHT ASSOCIATION DOCKET

13956. **Gravel**, carloads, Elk Creek, Penn., to Erie, Penn. (N. C. C. & St. L. R. R. delivery). Present rate, 90c per ton of 2000 lb.; proposed 80c per ton of 2000 lb.

13965. **Gravel and sand**, other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, Rochester, Penn., to Pennsylvania. Present and proposed rates: As shown in Exhibit "A" attached.

EXHIBIT "A"

Building Sand and Gravel, Carloads
From Rochester, Penn.

To	Proposed Rate	Present Rate
Altoona, Penn.	180	(4)
Apollo, Penn.	125	(4)
Arrow, Penn.	185	(4)
Ashtola, Penn.	170	(4)
Bedford, Penn.	190	(4)
Burnside, Penn.	185	(4)
Braeburn, Penn.	125	140 (1)
Burgettstown, Penn.	80	90 (2)
Buckeye Coal Co., Nemacolin Mine, Penn.	140	(4)
Canoe Creek Stone Co., Siding, Penn.	190	(4)
Cairnbrook, Penn.	185	(4)
Carnegie, Penn.	80	105 (1)
Clymer, Penn.	185	(4)
Coalport, Penn.	185	(4)
Corry, Penn.	140	(4)
Cresson, Penn.	170	(4)
Dias, Penn.	135	(4)
Dilltown, Penn.	150	(4)
Dixonville, Penn.	185	(4)
Donora, Penn.	140	150 (1)
Dunlo, Penn.	185	(4)
Eldorado, Penn.	185	(4)
Ebensburg, Penn.	185	(4)
Frankstown, Penn.	185	(4)
Ford City, Penn.	125	140 (1)
Freeport, Penn.	125	140 (1)
Gallitzin, Penn.	180	(4)
Garman, Penn.	185	(4)
Grampion, Penn.	205	(4)
Hastings, Penn.	185	(4)
Helca, Penn.	125	(4)
Horrel, Penn.	185	(4)
Irvona, Penn.	185	(4)
Irwin, Penn.	125	150 (1)
Johnstown, Penn.	140	230 (3)
Jeanette, Penn.	140	160 (1)
Julian, Penn.	195	(4)
Lilly, Penn.	170	(4)
Lovett, Penn.	170	(4)
Mather, Penn.	140	(4)
Mineral Point, Penn.	160	(4)
Moore's Mills, Penn.	190	(4)
Mammoth, Penn.	125	(4)
Natrona, Penn.	125	140 (1)
Patton, Penn.	185	(4)
Pitcairn, Penn.	125	140 (1)
Portage, Penn.	170	(4)
Port Matilda, Penn.	195	(4)
Ramey, Penn.	205	(4)
Rhodes, Penn.	205	(4)
Rimersburg, Penn.	150	(4)
Sligo, Penn.	150	(4)
Smith, Penn.	135	(4)
Snoe Shoe, Penn.	205	(4)
Summerhill, Penn.	160	(4)
Trafford, Penn.	125	140 (1)
Treveskyn, Penn.	105	(4)
Twin Rocks, Penn.	160	(4)
Tyrone, Penn.	185	(4)
Unionville, Penn.	195	(4)
Valley Camp, Penn.	125	140 (1)
Vintondal, Penn.	160	(4)
Warren, Penn.	150	(4)
Wilmore, Penn.	170	(4)
Windber, Penn.	170	(4)
Wyano, Penn.	125	(4)

Rates in cents per net ton.
(1)—Intermediate from Beaver, Penn.
(2)—Intermediate from Wampum, Penn.
(3)—Intermediate from New Castle, Penn.
(4)—No commodity rates in effect; sixth class rate applicable.

13888. **Gravel and sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica), carloads, Dundee, Ind., to Curtisville, Windfall and Nevada, Ind. (P. R. R. delivery.) Present rate, sixth class; proposed, 80c per net ton.

13889. **Crushed stone** and crushed stone screenings, carloads, Bluffton, Ohio, to Tama and Rockford, Ohio. Present rate, sixth class; proposed, 80c per net ton.

13890. **Gravel and sand**, other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, Ambridge, Bladen and Freedom, Penn., to Tarr and New Comer, Penn. Present rate, sixth class; proposed, $1.20 to Tarr, Penn., and $1.35 per net ton to New Comer, Penn.

13901. **Gravel and sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica), carloads, Lafayette, Ind., to Lebanon, Ind. Present rate, 75c per net ton; proposed, 70c per net ton.

13909. **Gravel and sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica), carloads, Lafayette, Ind., to stations shown below, via N. Y. C. & St. L. R. R., Frankfort, and C. I. & L. Ry.

Destinations	—Per net ton.— Present	Proposed
Cyclone, Ind.	92	80
Kirklin, Ind.	92	80
Terhune, Ind.	92	80
Sheridan, Ind.	92	85

Proposed rates will not be subject to rules for constructing combination rates as per C. F. A. Tariff 228, I. C. C. U. S. 1.

13920. **Crushed stone**, carloads, Bellevue, Ohio, to Williard, Ohio. Present rate, sixth class; proposed, 70c per net ton.

13922. **Crushed stone**, carloads, Martin, Ohio, to Weston and Tontogany, Ohio. Present rate, 90c per net ton; proposed, 85c per net ton. The provisions of Agent Jones' Combination Tariff 228, I. C. C., U. S.-1, will not apply.

13826. To establish on **sand**, blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to full cubical or visible capacity, actual weight will apply.

To Clark's Hill, Frankfort, Linden, Veedersburg, Ind., and points taking same rates, rate of $2.14 per net ton from Sandusky Group and $2.52 per net ton from the Conneaut Group.

Present rate—$2.52 from the Sandusky Group and $2.65 per net ton from the Conneaut Group.

TRUNK LINE ASSOCIATION DOCKET

13799. **Slate**, ground or crushed, carloads, from Easton (13th St.), Penn., and Easton (Bushkill Sta.), Penn., to Baltimore, Md., 14½c per 100 lb. Reason: Rates are comparable with others on like commodities from and to points in the same general territory, carloads, minimum weight 50,000 lb. File 42013.

185. **Sand, glass**, carloads, from Hardman, W. Va. Rate, carloads, L. C. L., $3.91 per 2000 lb., to Brooklyn, N. Y.; B. & O., Brooklyn, N. Y.; Atlantic Terminal, N. Y. D., Baltic Terminal, N. Y. D., Fulton Terminal, N. Y. D., New York, N. Y., B. & O.

WESTERN TRUNK LINE DOCKET

2035-A. **Stone**, crushed, carloads, from Sioux Falls, S. D., to points shown below. Rates in cents per 100 lb.:

To	Present	Proposed
Fairfax, S. D.	*	11.5
Bonesteel, S. D.	*	12
St. Charles, S. D.	*	12.5
Herrick, S. D.	*	13
Burke, S. D.	*	13.5
Gregory, S. D.	*	14
Dallas, S. D.	*	14.5
Colome, S. D.	*	15
Winner, S. D.	15.5	15.5

*Through class rates except under Rule 77 Winner rate must be established on one day's notice.

Minimum weight 90% of marked capacity of car, but not less than 40,000 lb.

4112-A. **Lime**, carloads, from Duluth, Minn., to Merrill, Wis. Present, 29½c per 100 lb. (Class C); proposed, 19c per 100 lb. Minimum weight 40,000 lb. (By shipper.)

5649. **Brick, sand-lime**, not further finished than first molding and shipped not braced, wedged or packed for protection against rubbing, breaking or chipping, between stations in South Dakota. Present, normal brick rate; proposed, 80% of normal brick rate for distances 150 miles and less. Minimum weight marked capacity of car.

SOUTHWESTERN FREIGHT BUREAU DOCKET

9528. **Sand and gravel**, from Gravel Sand, Texas, and Wichita, Kans., to Lugert, Okla. To establish on sand and gravel, carloads, minimum weight marked capacity of car to Lugert, Okla., rate of 4c from Gravel Sand, Texas, and 6c per 100 lb. from Wichita, Kans. (plus K. C. M. & O. Ry. arbitrary of $10 per car). Rates to expire September 1, 1921, unless otherwise changed, cancelled or extended.

9435. **Sand and gravel**, from Pueblo, Colo., to Amarillo, Texas. To establish rate of 12c per 100 lb. on sand and gravel, carloads, minimum weight 90% of marked capacity of car, from Pueblo, Colo., to Amarillo, Texas. Sand and gravel moving from Pueblo to Amarillo would today be required to pay Class "E" rate of 47½c per 100 lb. For this low grade traffic this rate is too high, and shippers have requested reasonable rate on which the traffic can move.

9456. **Lime**, from points in Missouri and Arkansas to interstate points. To establish the following rates in cents per 100 lb. on lime, carloads, minimum weight 30,000 lb., from points on the St. L. S. F. Ry. in Groups 1 and 2, as per St. L. S. F. Ry. Tariff 69-K, to points shown on following page:

From Ash Grove To Iowa points M. & St.L.R.R.	(2) Rate
Huntington	20½
Estherville	20½
Raleigh	20½
Terrill	20½
Langdon	20½
Spencer	20½
Greenville	20½
Cornell	20½
Sioux Rapids	20½
Rembrandt	20½
Truesdale	20½
Storm Lake	20½
Ruthven	20½
Ayrshire	20½
Curlew	20½
Mallard	20½
Plover	20½
Rolfe	20½
Gilmore City	20½
Pioneer	20½
Clare	20½
Tara	20½
Mooreland	20½
Collinder	20½
Gowrie	20½
Lena	20½
Paton	20½
Dana	20½
Grand Junction	20½
Rippey	20½
Fort Dodge	20½
Kale	20½
Otho	20½
Burnside	20½
Dayton	20½
Pilot Mound	20½
Ogden	20½
Berkley	20½
Angus	20½
Perry	20½
Minburn	20½
Dallas Center	20½
Waukee	20½
Ashawa	20½

From Ash Grove To Iowa points M. & St.L.R.R.	(2) Rate
Valley Junction	20½
Minnesota points	
Sherburn	20½
Monterey	20½
Ormsby	20½
Echols	20½
St. James	20½
La Salle	20½
Hanska	20½
Searles	20½
New Ulm	20½
Klossner	20½
Lafayette	20½
Minnetonka Mills	20½
Deephaven	20½
Solbergs Point	20½
Excelsior	20½
Zumbra Heights	20½
Victoria	20½
Waconia	20½
Young America	20½
Norwood	20½
Hamburg	20½
Green Isle	20½
Arlington	20½
Gaylord	20½
Winthrop	20½
Gibbon	21½
Fairfax	21½
Franklin	21½
Morton	21½
Redwood	21½
Delhi	23½
Belview	25
Echo	26
Wood Lake	26½
Hanley Falls	26½
Hazel River	26½
Clarkfield	26½
Boyd	26½
Dawson	26½
Madison	26½
Haydenville	26½
Marietta	26½

(2) St. L.-S.F. Tariff 69-K, I. C. C. 8114. Rates from Johnsons, Ark., to be based the usual differential of 1½c over Ash Grove.

At the present time through rates are published from St. Louis and Hannibal, Mo., to points in Minnesota on the M. & St. L., Sherburn to Lafayette and Minnetonka Mills to Marietta, while the Ash Grove Mo., and Johnsons, Ark., groups enjoy no through rates to these points and complain of the discrimination.

9420. **Limestone**, from points in Missouri to points in Kansas. To establish the following mileage scale of rates in cents per ton of 2000 lb. on agricultural limestone, carloads. To apply only

on such agricultural limestone as has passed, or will pass, through a screen with round holes one-eighth of an inch or less in diameter, from Carthage, Blackwater and Pixleys, Mo., to points in Kansas.

	Via two lines	Via three lines
40 miles and under	70	80
50 miles and over 40	80	90
60 miles and over 50	85	90
70 miles and over 60	90	100
80 miles and over 70	95	100
90 miles and over 80	105	105
100 miles and over 90	110	110
110 miles and over 100	115	115
120 miles and over 110	120	120
125 miles and over 120	130	130
130 miles and over 125	130	130
140 miles and over 130	130	130
150 miles and over 140	135	135
160 miles and over 150	135	135
170 miles and over 160	140	140
175 miles and over 170	145	145
180 miles and over 175	145	145
190 miles and over 180	150	150
200 miles and over 190	155	155
210 miles and over 200	160	160
220 miles and over 210	160	160
230 miles and over 220	170	170
240 miles and over 230	170	170
250 miles and over 240	175	175

The proposed rates are based on the higher joint line distance scale now applicable on Missouri and Kansas intrastate traffic. The stone is to be used for fertilizer purposes and in order to enable farmers to use same it is very necessary that a low scale of rates be provided for.

ILLINOIS FREIGHT ASSOCIATION DOCKET

3825. **Crushed stone**, etc., carloads, from Krause and Columbia Quarry No. 2, Illinois. Present rates—Various, to following Illinois stations; proposed, to (Illinois stations) Pana, $1; Rosamond, Ohlman, Nokomis, Witt, Irving, Hillsboro, Livingston, 91c; Mitchell, Nameoki, 73c.

3791. **Sand and gravel**, carloads, minimum weight marked capacity of car, from Forreston, Ill., to Chenoa, Ill., Eureka, Ill., Washington, Ill., Farmdale, Ill. Present, combination basis; proposed, $1.14.

SOUTHERN FREIGHT ASSOCIATION DOCKET

28712. **Ground or pulverized limestone** to points in Florida. It is proposed—(a) To amend A. C. L. R. R. I. C. C. B-2415, and S. A. L. Ry. I. C. C. A-7150, applicable on ground or pulverized limestone, carloads, restricting rates published therein, not to apply to points in Florida south of S. A. L. Ry. Jacksonville-River Junction line. It is stated that it is not customary to apply the same scale through from southeastern points to South Florida points as apply between points north of the Jacksonville-River Junction line, and the publication of these scales to so apply was an oversight; and that rates on other commodities to Florida points are generally made on Jacksonville combination, using proportional rates to and beyond Jacksonville.

(b) To amend page 9 (list of commodities on which rates named in other tariffs are applicable) of Agt. Glenn's I. C. C. A-505 (Florida Basis Book), eliminating references to A. C. L. R. R. I. C. C. B-2207 and S. A. L. Ry. I. C. C. A-7150 on south-bound traffic.

(c) Publish specific commodity rates from Jacksonville, Fla. (when from beyond), to stations on the A. C. L. R. R. and S. A. L. Ry. using the scale which ranges from 60c for five miles up to 130 for 100 miles; $1.75 for 200 miles, $2.10 for 300 miles, $2.40 for 400 miles and $2.60 per net ton for 460 miles.

28726. **Gravel**, from Millers, Ala., to Thomaston, Hugo, Muskwa and Linden, Ala. It is proposed to establish the following reduced rates on gravel, carloads, minimum weight 90% of the marked capacity of the car, except when cars are loaded to their visible capacity, actual weight will govern, from Millers, Ala.: To Thomaston, 144; to the other destinations mentioned, 149 cents per ton 2000 lb.; made on basis of the carriers' proposed Alabama-Georgia joint line scale, less 10%.

28735. **Sand and gravel**, from Louisville, Ky., to O. & K. Ry. and Caney Valley Ry. stations. In lieu of combination rates, it is proposed to establish the following through rates on sand and gravel, straight or mixed carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight shall govern, from Louisville, Ky.: To O. & K. Ry. stations, Frozen, Ky., to Cannel City, Ky., inclusive, $2.15 per net ton; to Caney Valley Ry. stations, Caney, Ky., to Licking River, Ky., inclusive, $2.25 per net ton. The proposed rates it is thought reflect a reasonable difference over the present rates from Louisville, Ky., to O. & K. Junction, Ky., the point of interchange with the O. & K. Ry.

28798. **Gravel**, from Gigbee and Amory, Miss., to Pontotoc, Miss. In lieu or rate of $1.20 per net ton, it is proposed to establish rate of 90c per net ton on gravel (or other road building material), the property of federal, state, county or municipal governments, when consigned to such governments or an officer thereof, from Bigbee and Amory, Miss., to Pontotoc, Miss., or the same as rate in effect from Columbus, Miss.

28811. **Ground or pulverized limestone** or marble, from Sparta, Tenn., to Milledgeville, Ga. In lieu of Atlanta combination rate of $2.57, it is proposed to establish through rate of $2.34 per net ton on ground or pulverized limestone or marble, carloads, minimum weight marked capacity of car, except when loaded to full visible capacity, actual weight will apply, from Sparta, Tenn., to Milledgeville, Ga., made on basis of the proposed Georgia scale, less 10%.

28812. **Ground limestone**, from Sparta, Tenn., to Georgia R. R. stations. In lieu of present combination rates, it is proposed to establish through rates on ground limestone, carloads, minimum weight marked capacity of car, except when car is loaded to full visible capacity, actual weight will apply, from Sparta, Tenn., to all stations on the Georgia R. R. (except Milledgeville, Ga., and points to which through rates are at present in effect) made on basis of the Georgia proposed scale for distances via Atlanta, Ga.

28816. **Sand and gravel**, from Montgomery, Ala., and Western Ry. of Alabama pits to A. C. L. R. R. stations between Waycross and Albany, Ga. In lieu of rate of $1.71 per net ton, it is proposed to establish the following rates on sand and gravel, in straight or mixed carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from the origins named: To Waresboro, Sappville, Hasty, Fairfax, Millwood and Axson, Ga., $1.76; Pearson, Leliaton and Kirkland, Ga., $1.80, and to Willacoochee, Ga., $1.76 per net ton. The rates suggested are made on basis of the proposed Georgia scale, less 10% for the actual distance from Montgomery, Ala., via A. C. L. R. R.

28865. **Crushed stone**, from Milltown, Ind., to I. C. R. R. stations in Kentucky. It is proposed to establish rates on crushed stone, carloads, minimum wegiht 90% of marked capacity of car, except when car is loaded to full cubical or visible capacity, actual weight will apply, from Milltown, Ind., to stations on the I. C. R. R. in Kentucky, made on basis of the combinations which were in effect prior to February 1, 1926, by use of the combination rules published in Agent Jones' Combination Rules Tariff 228. Statement of proposed rates will be furnished upon request.

28868. **Sand and gravel**, from Montgomery, Ala., to West Farm and Lee, Fla. In lieu of combination rates, it is proposed to establish rate of $1.89 per net ton on sand and gravel, in straight or mixed carloads, minimum weight except when cars are loaded to their visible capacity, actual weight will apply, from and to points mentioned, same as present rate from Montgomery, Ala., to Madison and Ellaville, Fla.; also same as present rate to Jacksonville, Fla.

28896. **Sand**, from T. A. & G. Ry. stations to Atlanta, Ga., Charlotte, N. C., Knoxville, Tenn., Memphis and Nashville, Tenn. No through rates in effect. Proposed rates on sand, carloads, minimum weight stenciled capacity of car, except where cars are loaded to visible capacity and/or in the absence of weighing facilities at shipping point. If freight is weighed in transit or at desination, carloads, minimum weight will be 90% of the stenciled capacity of car, from Benjamin, Blue Pond, Little River and Yellow Creek, Ala. To Atlanta, Ga., $1.20; Charlotte, N. C., $2.25; Knoxville, Tenn, $1.49; Memphis, Tenn., $2.14; Nashville, Tenn., $1.92 per net ton. Proposed rates are the same as rates in effect from Gadsden, Ala.

28897. **Ground limestone**, from Whitestone, Ga., to Wetumpka, Ala. In lieu of Class "N" rate of $5.90 per net ton, it is proposed to establish rate of $2.60 per net ton on ground limestone, carloads, minimum weight 60,000 lb., from Whitestone, Ga., to Wetumpka, Ala.

28898. **Sand**, from Louisville, Ky., to Myrlin, Ky., and intermediate L. & N. R. R. stations. In lieu of rate of $1.70 per net ton, it is proposed to establish rate of $1.50 per net ton on sand, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight shall govern, from Louisville, Ky., to Myrlin, Ky. The proposed rate to be published to intermediate destinations to which the present rates are in excess of this rate. Proposed in order to meet competition of shippers at Knoxville, Tenn.

28900. **Sand**, from Spruce Pine, Ala., to Mt. Pleasant, Tenn. In lieu of combination rate of $3.17, it is proposed to establish through rate of $1.47 per net ton on sand, carloads, minimum weight 90% of the marked capacity of car, except that when cars are loaded to their visible capacity, actual weight shall govern, from Spruce Pine, Ala., to Mt. Pleasant, Tenn., made on the same basis as observed in establishing rate of $1.27 per ton from Spruce Pine, Ala., to Lawrenceburg, Tenn.

28905. **Lime**, from Flint, Graystone, Keystone, Long View, Saginaw, Varnons and Wilmay, Ala., to L. & N. R. R., N. C. & M. division stations. In lieu of rate of $3.49, it is proposed to establish rate of $2.59 per net ton on lime, carloads, minimum weight 30,000 lb., from origins named above to L. & N. R. R., N. C. & M. division stations, viz.: Pascagoula, Gautier, Hilda, Fontainebleau, Ocean Springs, Oak Street (Biloxi), Camp Ground, Heartsease, Beauvoir, De Buys and Miss. City, Miss., same as rate in effect to Gulfport, Miss.

28906. **Crushed stone**, crushed marble, etc., from Whitstone and Tate, Ga., to Morgontown, W. Va. In lieu of combination rates, it is proposed to establish the following through rates: From Whitestone, Ga.: On stone, crushed, carloads, minimum weight marked capacity of car, except when car is loaded to full cubical or visible capacity, actual weight will govern, $5.42 per net ton; on whitestone, powdered, carloads, minimum weight 90% of marked capacity of car, except that when cars are loaded to their visible capacity, actual weight will govern, $5.67 per net ton. From Tate, Ga.: On marble, crushed, carloads, minimum weight capacity of car, $5.42 per net ton; on marble, ground or pulverized, in bags, carloads, minimum weight capacity of car, $5.67 per net ton. Proposed rates same as in effect to Clarksburg and Grafton, W. Va., points in the same vicinity of Morgontown.

28949. **Ground limestone**, from Phoslime, Fla., to Florida points—Cancellation. It is proposed to cancel the present commodity rates on ground limestone, carloads, from Phoslime, Fla., to Florida points to which rates are published in S. A. L. Ry. Florida Points Tariff, I. C. C. A-7018, or as amended, account of no movement. Mileage rates or combination rates to apply after cancellation.

28955. **Sand and gravel**, from Selma, Ala., to Fountain, Ala. In lieu of combination rate of $2.20 per net ton, it is proposed to establish through rate of $1.31 per net ton on sand and gravel, in straight or mixed carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Selma, Ala., to Fountain, Ala., made on basis of the proposed Georgia scale, less 10%.

Western Cement Rates Established

ANOTHER attempt has been made by the Interstate Commerce Commission to line up rates on cement in parts of the territory covered by its report in Western Cement Rates, 48 I. C. C. 201, and subsequent reports, by means of orders issued in connection with No. 15428, Iola Cement Mills Traffic Association et al. vs. Arkansas Valley et al., mimeographed. Division No. 2 found rates from points in the Kansas Gas Belt, Bonner Springs, Kans.; Ada, Okla.; Superior, Nebr.; Portland and Concrete, Colo., to destinations in scale 3 and 4 territories, not unreasonable or unjustly discriminatory, except where lower rates from the gas belt could be arrived at by using the average of rates under Scales 2, 3 and 4, based on distances over routes through Scale 2 territory. It found rates from Superior to points in Scale 2 territory and Kansas City, Sioux City, Sioux Falls and from Ada and Kansas City, to points in Scale 2 territory and to points in Scale 3 territory unreasonable. It denied reparation except under particular circumstances.

Publication of new rates is to be made not later than October 12; the rates from Ada and Superior are to be made by applying the Scales 2 and 3, so as more nearly to give the benefit of each scale to the hauls within its territory, subject to the limitation that there shall be no fourth section relief except that the railroads will be permitted to hold border point rates as maxima at more distant points in lower-rated territory.

Rates of Sand and Gravel to Chicago District Ordered Revised

DISMISSAL of the main complaint in No. 17817, Chicago Gravel Co. et al. vs. Santa Fe et al., involving rates on sand, gravel and crushed stone from points in Illinois and Wisconsin to the Chicago-Gary switching district and other destinations, has been recommended by Examiner Burton Fuller. In No. 17817, Sub. No. 2, Neal Gravel Co. et al. vs. Santa Fe et al., the examiner recommended a finding of unjust discrimination against interstate commerce and prescription of rates to remove the discrimination.

Complainants in No. 17817, producers of sand and gravel at certain points in Zones I and II in Wisconsin and of crushed stone at Joliet, Ill., in Zone I, and at Racine, Wis., in Zone II, alleged that the rates on their commodities to the Chicago-Gary switching district were and had been since September 10, 1925, unreasonable and unduly prejudicial to complainants and unduly preferential of producers of sand, gravel, crushed stone and slag located within the Chicago switching district and within Zones II and III in Illinois, Indiana and Wisconsin. Zones I, II and III embrace producing points within 50 miles, 51 to 100 miles, and 101 to 150 miles of Chicago, respectively. Complainants also alleged that the interstate rates on these commodities from Algonquin, Aurora, Carpentersville, Crystal Lake, Elgin, Hammonds, Libertyville, Mundelein, South Elgin, and Liberty Lake, Ill., in Zone I, and Fontana, Racine, and Wilmot Pit, Wis., in Zone II, to destinations on the North Western, Milwaukee, Soo, and North Shore in northern Illinois, eastern Iowa, and southern Wisconsin, had been and were since September 10, 1925, unreasonable and unduly prejudicial to complainants located at those points and unduly preferential of other producers in Zone II and producers in Zone III located on the lines named. The Commission was asked to prescribe reasonable and nonprejudicial rates for the future and to award reparation.

Complainants further alleged that the failure and refusal of the Milwaukee to absorb the switching charge on this traffic of the North Western and North Shore at Elgin, Ill., and Racine, Wis., respectively, while contemporaneously absorbing the corresponding switching charges of the North Western at Janesville, Wis., was unduly prejudicial to complainants at Elgin and Racine and unduly preferential of their competitors at Janesville.

With reference to absorption of switching charges, Examiner Fuller said:

The plant on the North Western, at Elgin, is the only plant at that point. The plant on the North Shore, at Racine, is not within the corporate or recognized city limits of Racine. There are plants on both the Milwaukee and North Western within the corporate or recognized switching limits of Janesville, and as each serves substantially the same deliveries in Chicago, each absorbs the switching charges of the other at Janesville in order to get a fair share of the business. The Milwaukee absorbs the switching charges of the C. H. & G. L. at Fontana, Wis. There is no adequate basis for a finding of undue prejudice.

The examiner's conclusions follow:

In No. 17817, the Commission should find that (1) the rates from complainants' plants to the Chicago, Ill.-Gary, Ind., district and other destinations in northern Illinois, southern Wisconsin and eastern Iowa, were, and are not unreasonable or unduly prejudicial; and (2) that the failure and refusal of the Milwaukee to absorb the switching charges on this traffic of the North Western and North Shore at Elgin, Ill., and Racine, Wis., is not unduly prejudicial.

In No. 17817, Sub No. 2, the Commission should find that the intrastate single and connecting-line rates from certain points in Zone I and the intrastate connecting-line rates from Zones II and III to the Chicago district are unjustly discriminatory against interstate commerce. The Commission should further find that this unjust discrimination should be removed by the establishment and maintenance of the rates set forth in Jones 420, both interstate and intrastate, except that the single-line rates from Zone III points in Illinois on the Burlington, Rock Island and Santa Fe, including Ottawa, Ill., and from Zone III points in Indiana, including Summit Grove, Ind., should be not less than 85 cents per net ton and the single line rates from Zone II points in Indiana should be not less than 80 cents per net ton.

The complaint in No. 17817 should be dismissed. It is anticipated that the three commissions will make harmonious findings in these cases, whereupon the carriers should promptly comply therewith, in which event no order will be necessary in No. 17817, Sub No. 2. The findings herein approving the so-called double rate basis to the Chicago district are made with respect to the particular traffic under consideration and are not to be taken as a precedent for other traffic which does not compete therewith.

Reverse Ruling on Cement

THE commission, by division 3, has reversed its former finding in No. 11997, Divie Portland Cement Co. vs. Director General, as agent, mimeographed, as to reparation on carload shipments of cement from Richards City, Tenn., to Miami, Daytona, Cocoanut Grove, West Palm Beach and Canal Port, Fla., found the cement had been misrouted, and awarded reparation. In the former report, 83 I. C. C. 417, the division found that the rates were not unreasonable, but that the shipments were misrouted. It authorized the waiving of the collection of outstanding undercharges, and dismissed the complaint. The question was as to the application of the combination rule in the Washburn tariff. The division said the issue in this case was substantially the same as that in the Acme Cement Plaster Co. vs. Director General, 81 I. C. C. 298, in which the combination rule was found to apply. Upon further consideration in this record it found the shipments were misrouted and that the complainant was entitled to reparation, to the basis of the Jacksonville combination in effect prior to June 25, 1918, plus 2 cents.

Central Territory Revised Lime Tariff Postponed

THE revision of rates on lime from Indiana and eastern points to the central territory which was to have become effective August 20 has been postponed to November 20, by order of the Interstate Commerce Commission. The order was the result of a complaint by the Eastern Lime Manufacturers' Traffic Bureau against the Baltimore and Ohio Railroad Co. and a score or more of other transportation companies. The revised rates were printed in ROCK PRODUCTS June 12 issue.

Gravel Rate Suspended

PROPOSED new rates on gravel and crushed rock transported on the Chicago, Burlington and Quincy railroad from Bay City, Wis., to Fordson, Minn., recently were suspended by the Interstate Commerce Commission from June 25, when they were to have gone into effect, to October 23. The carrier had sought to increase rates from 60 cents to $1 a ton.

Crushed Stone Rates Upheld

THE Interstate Commerce Commission, by division 3, has dismissed No. 17255, West Virginia State Road Commission vs. Pennsylvania R. R. et al., mimeographed, finding the rate charged on crushed stone, from Marble Cliff, Ohio, to Cairo, W. Va., between May and September, 1924, not unreasonable or otherwise unlawful. The complaint alleged the rate was unreasonable to the extent it exceeded $1.44 per net ton.

Silica Sand Rate Reasonable

IN a mimeographed report by division 2, the Interstate Commerce Commission has dismissed the complaint in No. 17060, Frohman Chemical Co. vs. Baltimore and Ohio et al., on a finding that a rate of $3.15 per net ton on silica sand from Ottawa, Wedron and Utica, Ill., to Sandusky, Ohio, was and is not unjust or unreasonable. A rate of $2 was sought. The commission said the record failed to establish that the rate assailed was or would be unreasonable.

Lime Rate Too High

A FINDING of unreasonableness and undue prejudice has been made in No. 17317, Woodville Lime Products Co. vs. Pennsylvania et al., mimeographed, as to a combination rate of 27.4 cents on lime, from Woodville, Ohio, to Fulton Station, Md. That is a point on the Western Maryland and 27.4 was the lowest combination. The commission, by division 4, found it unreasonable to the extent it exceeded a rate of 25.5 cents, applicable to Pennsylvania stations in Baltimore. Carriers are expected to establish that rate within 60 days via a reasonably direct route, failing which the matter may again be brought before the commission.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Making 4000 Block a Day on Two Machines

Philadelphia Plant Can Keep This Up Indefinitely

THE Landown Concrete Specialty Co. operates a plant in one of the newer Philadelphia suburbs, beyond the end of the elevated railway at 69th street. It is not an incorporated company but a partnership of John L. Walter and Harry W. Fanning. Mr. Walter acts as manager and sells the product.

The blocks are made from a somewhat unusual aggregate, a mixture of slag and cinders. This makes a good, strong block, with a compressive strength of 1000 lb. or more per sq. in., and one that is fairly light, as the weight is 40 lb. for the 8x8x16-in. block.

The plant was built in 1925 in five days, the haste being necessary to have the plant erected before a threatened injunction restraining the owners from building it could issue.

No sooner did the plant begin business than it was swamped with orders. "I could have sold a million block in those days if I could have got them," was the way Mr. Walter put it.

This is a situation that often is found in the cement products industry. A rapidly growing community wants the product of a plant very badly and is quite willing to pay for it, but as soon as someone starts to put in a plant the people of the community band together to prevent him. It is hardly understandable, since a block plant creates no dust or other nuisance and need not be unsightly—especially if the builders are given time to put up a neat looking structure.

In this case sheds were erected as rapidly as possible and two "Anchor" strippers were hastily installed. They have been running ever since and can turn out an average of 4000 block per day. On the afternoon the plant was visited one of the machines was being given some minor repairs and the rate of the other machine was such that it would turn out more than 2300 block before the end of the day.

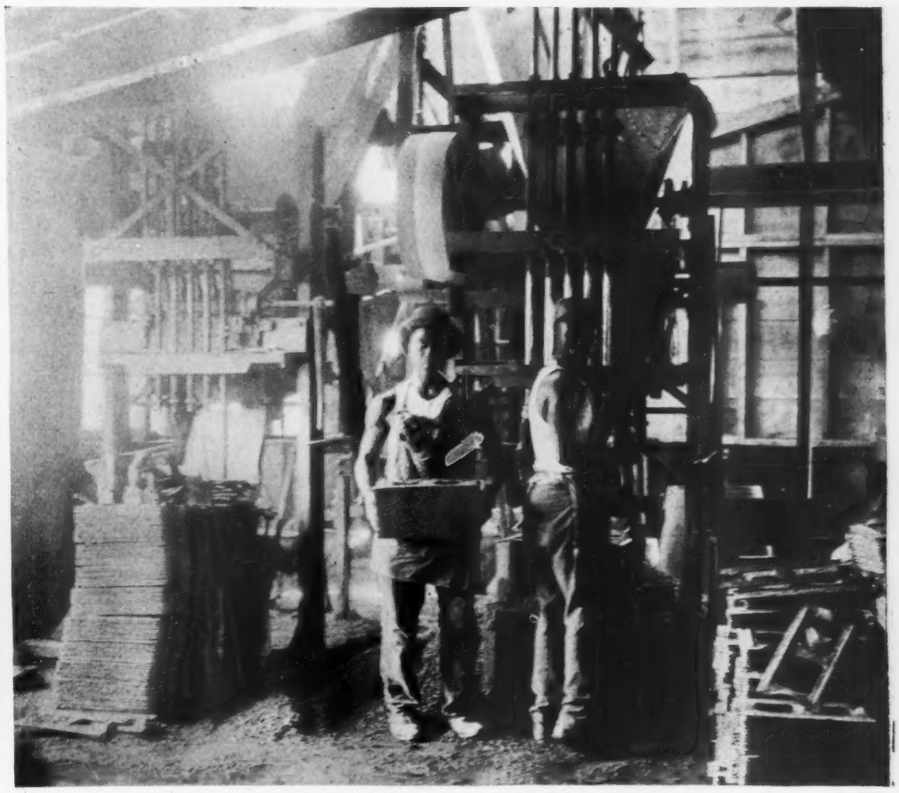
Colored labor is employed in this plant, as it is in so many of the block plants in the eastern states.

The mixed aggregate is combined just before it goes to the mixer. There are two bins on the ground floor, one for sand and one for crushed cinders. The slag is bought crushed to the proper sizes for making concrete products and is bought from a concern that supplies a number of block plants with aggregate.

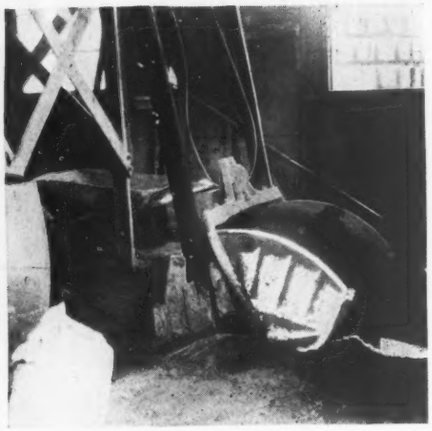
The cinders have to be crushed. They are received in truck loads which are dumped on the ground in front of a "New Holland" jaw crusher which is below the ground level. The crusher is fed by a workman with a shovel who has only to push the cinders from the pile to the crusher mouth. The crusher product is elevated to a screen and the oversize is crushed in a pair of 16-in. rolls of the same make as the crusher. The product of the rolls goes to a bin by the side of the slag bin.

The bucket which feeds the Blystone

How block are stacked for air curing



These two machines turn out 4000 block a day



Mix is proportioned in this bucket and elevated to mixer

mixer is filled from these bins by a workman who counts the shovelfuls of each according to instructions given him. Cement is added from the sack and the bucket hoisted and dumped into the mixer where it is given a 2-min. dry mix. Then water is added and a 2-min. wet mix is given.

Air curing is used altogether, the necessary moisture being given by spraying the blocks from time to time. The blocks are stacked with strips of wood between each.

Embankment Test of Pipe

ON preliminary experiments carried on at the Engineering Experiment Station at Ames, Iowa, to determine the supporting strength of culvert pipe in an actual embankment, the results semed to show that the actual load carried by such pipe will have a ratio of about 2.6 to the 3-point laboratory test generally used.

This difference is accounted for in part by the side pressure of the earth in the embankment, but it was estimated that without this side support the ratio would still be about 1.9.

Concrete culvert pipe were used for this test, made at the plant of the Wilson Concrete Co., Des Moines, Iowa.

Effect of Hot Water Vapor on Concrete Products

Result of Tests Presented Before Convention of Northwest Concrete Products Association

By A. L. Miller

Assistant Professor of Civil Engineering, University of Washington

IT is generally recognized that the steam curing of concrete products hastens their acquisition of strength. There appears to be very little information on the exact effect of this method of curing. This paper is a brief report of the results of a series of experiments recently performed in the concrete laboratory of the University of Washington and, it is hoped, may serve in a small way to add to the scant store of information now available on the subject.

It is necessary to restate and amplify the subject of this report. More fully stated, it is: To discover the effect of the application of water vapor at temperatures between 125 and 212 deg. F. on the strength of a mixture of portland cement, sand and water during the first 8 hr. after mixing. The term "water vapor" instead of "steam" is used because, accurately speaking, steam does not exist at atmospheric pressure at a temperature of less than 212 deg. F. What is ordinarily referred to as steam should be more properly called water vapor, which is a mechanical suspension of minute particles of water in air.

The procedure of this investigation was as follows: Specimens, 360 in number, of a 1:3 proportion by weight of cement and sand were prepared in four groups of 90 each. Sufficient water was added to permit the formation of the specimens in much the same manner as concrete products. The water-cement ratio was 0.67. The specimens were cylinders, 2 in. in diameter and 4 in. in length. The cylinders of each group were made as nearly simultaneously as possible by tamping in brass molds on steel pallets. The molds were immediately removed. A series of each group was placed in the water vapor at hourly intervals from 1 to 7 hr. Three cylinders of each series were removed from the heat at hourly intervals and tested in compression.

The temperature was obtained by introducing free steam into a fairly tight concrete steam chest and was recorded continuously by a recording hygrometer, the two bulbs of which were placed at extreme corners of the compartment. The recorded temperatures were constant except for variations caused by opening the door to introduce and remove the specimens. A relative humidity of 100% was maintained at all times. Four ranges of temperature were used, 125, 150, 180, and 212 deg. F.

The procedure outlined was followed in order to study the two vital elements of the treatment at a given temperature, namely, the effect of the age of the specimen when placing in the heat and the relative effects of various lengths of time of treatment.

General Results

In view of the brief nature of this report the results are more clearly and concisely explained by omitting any attempt at a verbal explanation and relying entirely on the accompanying chart. This chart presents the relation of the strengths to the various conditions and periods of treatment. The vertical scale is in terms of the total compressive strength of the cylinders in pounds. The horizontal scale gives the age of the specimens reckoned from the time of mixing.

The points represent the strongest specimen of each set of three. The reason for comparing the maximums rather than the averages is that experimental errors tended to underrate the strengths. Limited time and the impossibility of capping the cylinders introduced the most considerable errors. A comparison of the means would give almost identical results except for a few points in which the experimental error is very evident. Since these results are intended for comparison only, and no attempt will be made to express them in terms of unit stress, this method of analysis seems justified.

Three sets of curves appear on the chart,

Plant of Landown Concrete Specialty Co. near Philadelphia

representing temperatures of 125, 150, and 180 deg. F. The fourth group, that for 212 deg. F., is omitted for reasons which will be stated later. The curves of each set are numbered according to the ages of the specimens at the time of placing in the heat.

Visible Physical Results

The visible results are of particular importance. It was originally intended to place a series of each group in the heat immediately after making. This was tried at 212 and 125 deg. F., with the result that the cylinders disintegrated within the first 15 min. in the water vapor. The disintegration was due to two causes.

First—The cold specimens placed in a condition of higher temperature and 100% relative humidity slumped considerably due to the condensation of moisture on the cold material. The additional moisture was sufficient to decrease the consistency to such an extent that the cylinders could not support their own weights.

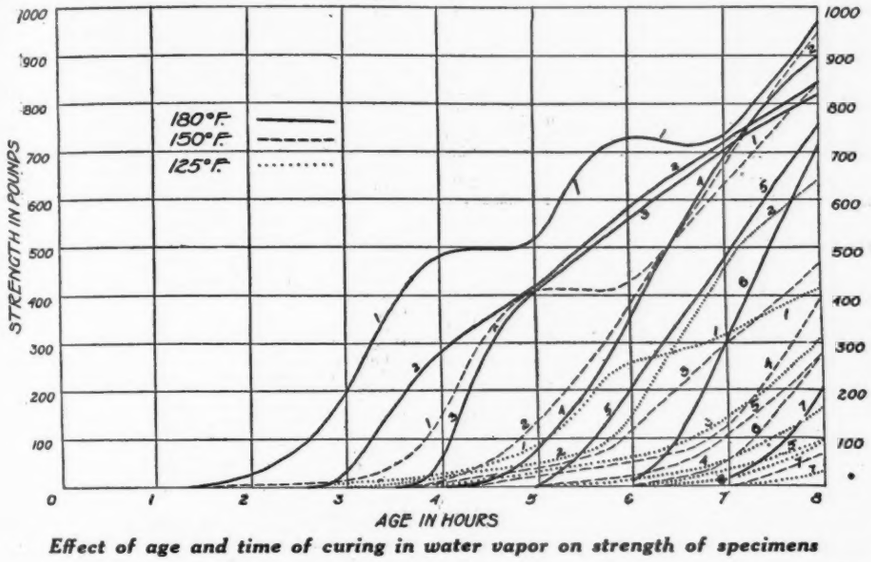
Second—The sudden increase in temperature caused the cylinders to expand quickly and unevenly, producing diametral cracks extending throughout the length. At ages up to 6 hr. the 212 deg. group developed these cracks. Tests of these specimens showed such wide variation that they should not be considered in this report. At 180 deg. cylinders treated at the age of 1 hr. showed slight cracks. None of the other series was visibly affected.

Effect of Age of Specimen

An examination of the curves marked "One" reveals a striking similarity. Their irregular shape would seem to indicate that the application of heat to specimens 1 hr. old either produces deleterious physical effects which are not visible or a derangement of the normal order of progression of the chemical reactions.

Specimens placed in the heat at an age of 2 hr. or more acquired strength at a fairly regular rate. The rate appears to increase as the age of the specimen at the time of beginning the treatment increases. Attention is called to the slight irregularities in the curve for the 180 deg. groups for 2, 3 and 4 hr. specimens. These variations are probably caused by the same factors as affected the 1 hr. specimen, only to a much less extent.

For the acquisition of a given strength at a given temperature, the length of treatment is subject to a wide variation, depending on the age at which the treatment was begun. The older specimens acquire strength in a much shorter period than the newer ones.



Effect of age and time of curing in water vapor on strength of specimens

Effect of Various Temperatures

For a given cylinder, and in the range between 125 and 180 deg. F., the higher the temperature the more rapid is the development of strength. The difference between 125 and 150 deg. is more marked than that between 150 and 180 deg. The advantage of 180 over 150 deg. is much less than the advantage of 150 over 125 deg.

Cylinders left at room temperature did not possess sufficient strength at the end of 8 hr. to record on the testing machine. They failed under a load of less than 20 lb.

Conclusions

In most industries, the direct application of laboratory experiments to commercial practice should be undertaken with considerable discretion. To see the work just outlined directly applied in the operation of concrete products plants is not the intention of this report. It is hoped, however, that this work may serve as a basis for further investigations in a more practical way. The practical advantages of more rapid curing are too well known to be mentioned here.

The following general conclusions seem justified:

1. The use of hot water vapor for curing during the first 8 hr. has a very marked effect on the rate of hardening. It is possible that a proper application of heat and humidity will result in a more efficient production of concrete products.

2. A temperature of 212 deg. F. should not be applied to concrete products less than 8 hr. old. Whether or not it is advisable to use this temperature on older specimens should be a subject of further investigation.

3. Warm water vapor should not be applied to specimens less than 2 hr. old.

4. The older the specimen the more rapid is the increase in strength for a given treatment.

5. Up to 180 deg., the higher the temperature the greater is the increase in strength in a given time. The relation of the increases has been previously noted.

In conclusion, a number of important points not directly indicated by the results of this investigation should be called to attention.

1. The requisite strength of a given product to resist handling should be determined. In this experiment, cylinders with a compressive strength of over 300 lb. could be safely handled, while those over 600 lb. withstood a surprising amount of rough treatment. Obviously, the strength of the concrete in the drain tile and building block, for example, would not be the same to permit handling.

2. The removal of the specimens from the heat is followed by a sudden drying out. Recent reports indicate that if the lost moisture is replaced within a reasonable time no damage is done.

3. It must be borne in mind that the relative humidity should be 100%, if possible, during this stage of the curing.

4. Probably a more pronounced effect will be noted in the case of products with relatively thin walls, while the reverse will be true for more massive pieces.

5. A study of the effect of curing in hot water vapor on the final strength of concrete is advisable. I have recently received a confidential report on a series of tests which indicates an ultimate final strength as much as 30% less than that of untreated specimens. I do not vouch for the correctness of the results nor the procedure, but in my opinion a serious question is raised.

Various Farm Uses of Concrete

THE building of many small concrete structures useful on the farm is feasible by the farmer himself, provided a few simple directions are observed, says the United States Department of Agriculture.

Farmers' Bulletin 1480, "Small Concrete Construction on the Farm," just issued, describes and illustrates how to build sidewalks, feeding floors, basement and barn floors and similar pavements, tanks, etc.

The bulletin gives a great deal of information relative to the use of concrete on the farm. A copy may be obtained free by writing to the United States Department of Agriculture, Washington, D. C.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	1.65	1.65	1.40	1.40	1.40
Cobleskill, N. Y.	1.50	1.35	1.25	1.25	1.25	.....
Danbury, Conn.	1.50@2.00	2.00	1.75	1.50	1.35	1.25
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Frederick, Md.	.50@ .75	1.20@1.30	1.15@1.25	1.10@1.15	1.10@1.15	1.05@1.10
Munns, N. Y.	1.00	1.35	1.35	1.25	1.25	.....
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	.....
Prospect, N. Y.	1.00	1.50	1.40	1.30	1.30	.....
Watertown, N. Y.	.50	.....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Afton, Mich.	.....	.....	.50	.....	.....	1.50
Alton, Ill.	1.85	.....	1.85	.....	.....	.....
Bloomville, Middlepoint, Dunkirk, Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio; Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.00	1.00	1.00
Buffalo and Linwood, Iowa	1.00	.....	1.10	.90	.95	.95
Carey, Ohio	1.05	1.05	1.05	1.05	1.05	1.05
Chasco, Ill.	1.00@1.30	.....	1.00@1.15	.....	1.00@1.15	.....
Columbia and Krause, Ill.	1.00@1.50	.90@1.10	1.20@1.35	1.00@1.20	.90@1.20	.....
			Flux 1.50@1.75			
Greencastle, Ind.	1.25	1.25	1.15	1.05	1.05	.95
Lannon, Wis.	.80	.80	1.00	1.00	.90	.90
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
Milltown, Ind.	.....	90@1.10	.90@1.15	.90@1.00	.85@.90	.85@.90
River Rouge, Mich.	1.20	1.20	1.20	1.20	1.20	1.20
St. Vincent de Paul, Que.	.75	1.25	.90	.85	.80	1.00
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	.....
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Ont.	1.50	2.00	2.00	1.85	1.85	1.85
Stone City, Iowa	.75	.....	†1.10	1.05	1.00	.....
Waukesha, Wis.	1.10	.....	.90	.90	.90	.90
SOUTHERN:						
Alderson, W. Va.	.50	1.35	1.35	1.25	1.20	1.15
Brooksville, Fla.	.75	.....	2.65	2.65	2.40	2.00
Cartersville, Ga.	1.50	1.50	1.50	1.35	1.25	1.15
Chico, Texas	1.00	1.35	1.35	1.25	1.15	1.00
El Paso, Tex.	1.00	1.00	1.00	1.00	.....	.....
Ft. Springs, W. Va.	.50	1.60	1.50	1.35	1.25	.....
Graystone, Ala.			Crusher run, 1.00 per ton			
Kendrick and Santos, Fla.			3½ in. and less, 1.00 per ton			
New Braunfels, Tex.	.30@1.00	1.00@1.30	1.00@1.30	.70@1.00	.70@ .90	.....
Olive Hill, Ky.	.50@1.00‡	1.00	1.00	1.00	1.00	1.00
Rocky Point, Va.	.50@1.00	1.40@1.60	1.30@1.40	1.15@1.35	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kans.	.25	1.90	1.90	1.90	1.90	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.25	.....	1.25	1.25	1.10	.....
Kansas City, Mo.	.75	1.50	1.50	1.50	1.50	1.50
Rock Hill, St. Louis Co., Mo.	1.40	1.40	1.40	1.40	1.35	1.35

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Duluth, Minn.	.90	2.25	1.90	1.50	1.35	1.35
Dwight, Calif.	1.00	1.00	1.00	.90	.90	.....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Texas	2.50	2.00	1.55	1.25	1.15	1.15@1.50
New Haven, New Britain, Meriden & Wallingford, Conn.	.80	1.70	1.45	1.20	1.05	1.05
Northern New Jersey	1.40	1.40	1.80	1.40	1.40	.....
Oakland and El Cerito, Cal.	1.00	1.00	1.00	.90	.90	.....
San Diego, Calif.	.....	2.75	2.55	2.35	2.35	.....
Sheboygan, Wis.	1.00	1.10	1.10	1.10	1.10	.....
Springfield, N. J.	1.70	2.10	2.10	1.70	1.60	1.60
Toronto, Ont.	.....	3.53@4.00	.....	3.00@3.75	.....	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	.....
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Columbia, S. C.	.75	2.00	1.75	1.75	1.60	1.60
Eastern, Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Lithonia, Ga.	.75	1.75b	1.75	1.40	1.40	.....
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.	3.00@3.50	.....	2.00@2.25	2.00@2.25	.....	1.25@3.00
Richmond, Calif.—Quartzite	.75	.....	1.00	1.00	1.00	.....
Somerset, Pa. (sand-rock)	1.85@2.00a	.....	1.35@1.50	.....	1.00@1.50	.....
Tocoa, Ga.—Granite	.50	1.50	1.50	1.40	1.35	1.35

*Cubic yd. †1 in. and less. ‡Two grades. ‖Rip rap per ton. (a) Sand. (b) to ⅛ in. (c) 1 in., 1.40. (d) 2 in., 1.30. (e) Dust. (f) ¼ in. (h) less 10c discount. (i) 1 in., 1.40. (k) on cars, less 5c per ton discount.

Agricultural Limestone

(Pulverized)

Alderson, W. Va.—50% thru 50 mesh	1.50
Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh	6.00
Asheville, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Belfast and Rockland, Me. (rail), Lincolnville, Me. (water), analysis $CaCO_3$ 90.04%; $MgCO_3$ 1.5%, 100% thru 14 mesh, bags	4.50
Bulk	3.50
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Branchton and Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; pulverized; 50% thru 50 mesh	1.50
Cartersville, Ga.—Pulverized, 2.00; 50% thru 50 mesh	1.50
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Chico, Texas.—50% thru 50 mesh, bulk	1.50
Colton, Calif.—Analysis 90% $CaCO_3$, bulk	4.00
Cypress, Ill.—90% thru 100 mesh	1.35
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.00; bulk	2.50
Joliet, Ill.—90% thru 100-mesh	4.24
Knoxville, Tenn.—80% thru 200 mesh, 80% thru 100 mesh, bags, 3.50; bulk	2.50
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marion, Va.—Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 90% thru 100 mesh	3.90@ 4.50
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—50% thru 50 mesh, 2.00; 90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis, $CaCO_3$, 95%; $MgCO_3$, 0.75%; 50% thru 100 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Syracuse, N. Y.—Analysis, 89% $CaCO_3$; $MgCO_3$, 4%; bags, 4.25; bulk	2.75
Toledo, Ohio, 30% through 50 mesh	2.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh, 2.10; 90% thru 50 mesh	1.65
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50
West Stockbridge, Mass.—Analysis 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk	3.25

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—50% thru 4 mesh	.50
Bedford, Ind.—Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 10 mesh	1.50
Brandon and Middlebury, Vt.—Pulverized, bags, 5.50; bulk	3.50

(Continued on next page)

Agricultural Limestone

Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh 1.75
50% thru 4 mesh 1.50
Chasco, Ill.—50% thru 100 mesh 1.20
Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh ..... .80
Columbia, Krause, Valmeyer, Ill.—Analysis, 90% $CaCO_3$; 90% thru 4 mesh 1.35
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh 1.35
Danbury, Conn.—Analysis, 81 to 85% $CaCO_3$ ..... 3.75@ 4.75
Dundas, Ont.—Analysis, 53.8% $CaCO_3$; $MgCO_3$, 43.3%. 100% thru 10 mesh, 40% thru 50 mesh, 25% thru 100 mesh 1.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh 1.50
Garnet, Okla.—All sizes 1.25
Kansas City, Mo.—50% thru 100 mesh ..... .75
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh 2.00
Screenings (¼ in. to dust) 1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk 1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh .... 1.85@ 2.35
McCook, Ill.—90% thru 4 mesh ..... .90
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 25 to 45% thru 100 mesh 1.60
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh 1.50
Monroe, Mich. — Analysis, $CaCO_3$, 52.03%; 42.25% $MgCO_3$; 30% thru 100 mesh 2.30
Mountville, Va. — Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%. 100% thru 20 mesh; 50% thru 100 mesh bags 5.50
Pixley, Mo.—Analysis, 96% $CaCO_3$; 50% thru 50 mesh 1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh 1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk ..... .80@ 1.40
Stone City, Iowa. — Analysis, 98% $CaCO_3$; 50% thru 50 mesh ..... .75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes 1.25

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk 3.00
Joliet, Ill.—90% thru 200 mesh 4.00
Piqua, Ohio, sacks, 4.50@5.00 bulk. 3.00@ 3.50
Rocky Point, Va.—80% thru 200 mesh, bulk 3.00
Waukesha, Wis.—90% thru 100 mesh, bulk 4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W.Va.—Glass sand .. 2.25
Buffalo, N. Y. ..... 2.00@ 2.50
Cedarville and S. Vineland, N. J.—
Damp 1.75
Dry 2.25
Columbus, Ohio ..... 1.00@ 1.50
Estill Springs and Sewanee, Tenn. 1.50
Franklin, Penn. 2.00
Gray Summit and Klondike, Mo. ..... 1.75@ 2.00
Los Angeles, Calif.—Washed 5.00
Mapleton Depot, Penn. ..... 2.00@ 2.25
Massillon, Ohio 3.00
Mendota, Va. ..... 2.25@ 2.50
Mineral Ridge and Ohlton, Ohio 2.50
Oceanside, Calif. 3.00
Ottawa, Ill. ..... .75@ 1.25
Pittsburgh, Penn. ..... 3.00@ 4.00
Ridgway, Penn. 2.50
Rockwood, Mich. ..... 2.75@ 3.25
Round Top, Md. 2.25
San Francisco, Calif. ..... 4.00@ 5.00
St. Louis, Mo. 2.00
Sewanee, Tenn. 1.50
Thayers, Penn. 2.50
Utica, Ill. ..... 1.00@ 1.25
Zanesville, Ohio 2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.50@ 1.75
Columbus, Ohio		.30@ 1.50
Dresden, Ohio		1.00
Eau Claire, Wis.	4.25	.60@ 1.00
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.40	1.40	2.25		2.25	2.25
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.		1.00*		1.50*	1.75*	
Farmingdale, N. J.	.58	.48	.75	1.20	1.10	
Hartford, Conn.	.65*					
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias Jct., N. Y.		.75	.75		.75	
Montoursville, Penn.		1.00	.75	.75	.75	.75
Northern New Jersey	.40@ .50	.40@ .50	1.25	1.25	.90@1.25	
Olean, N. Y.		.75	.75		.75	
Portland, Me.	1.00	1.00	2.25		2.00	
Shining Point, Penn.			1.00	1.00	1.00	1.00
Somerset, Pa.		1.85			1.50	
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.60@ .85	.60@ .85	1.70	1.50	1.30	1.30
CENTRAL:						
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Appleton and Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Attica, Ind.			All sizes .75@.85			
Aurora, Oregon, Sheridan, Moronts, Yorkville, Ill.	.60	.50	.40	.50	.60	.55
Barton, Wis.		.75		.75	.75	.85
Chicago, Ill.	.70	.60	.50	.60	.60	.60
Columbus, Ohio		.70	.70	.70	.70	
Des Moines, Iowa		.40	1.50			
Eau Claire, Wisc.	.60@1.25	.45	.85@1.25	.95	.95	
Elgin, Ill.		.20*	.50*	1.50*	1.50*	1.50*
Elkhart Lake, Wis.	.50	.30	.40	.50	.50	.40
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Grand Haven, Mich.		.60@ .70		.70@ .90		.70@ .90
Grand Rapids, Mich.		.50		.80	.80	.70
Hamilton, Ohio		1.00			1.00	
Hersey, Mich.		.50				.70
Humboldt, Iowa	.50	.50	1.50	1.50	1.50	1.50
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Joliet, Plainfield and Hammond, Ill.	.60	.50	.50	.60	.60	.60
Mason City, Iowa	.50	.50	1.45	1.45	1.45	1.35
Mattoon, Ill.	.75	.75	.75	.75	.75	.75
Milwaukee, Wis.		1.01	1.21	1.21	1.21	1.21
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.50	.50	1.50	1.25	1.25	
Palestine, Ill.	.75	.75	.75	.75	.75	.75
Pittsburgh, Penn.	1.25	1.25	.85	.85	.85	.85
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
St. Louis, Mo.	.93	1.45	1.55a	1.45	1.45	1.45
Terre Haute, Ind.	.75	.60	.90	.75	.75	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.10	1.10
Zanesville, Ohio		.60	.50	.60	.80	
SOUTHERN:						
Charleston, W. Va.			All sand, 1.40.	All gravel, 1.50.		
Chattanooga, Tenn.		1.65			1.45	
Chattahoochie River, Fla.		.70		1.75		
Eustis, Fla.		.60@ .70				
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.00
Lindsay, Texas					.55	
Macon, Ga.		.50	.50			
New Martinsville, W. Va.	1.00	.90@1.00		1.30		.80@ .90
Roseland, La.	.50	.50	2.50	1.35	1.10	1.10
WESTERN:						
Kansas City, Mo.	1.00	.70				
Los Angeles district (bunkers)†	1.50	1.40	1.85	1.85	1.85	1.85
Phoenix, Ariz.	1.25*	1.00*	2.50*	2.00*	1.75*	1.50*
Pueblo, Colo.	.80	.65		1.35		1.20
San Diego, Calif.	.65@ .75	.65@ .75	1.50	1.30	1.10	1.10
Seattle, Wash. (bunkers)	1.50*	1.50*	1.50*	1.50*	1.50*	1.50*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
East Hartford, Conn.			Sand, .75*			
Ferrysburg, Mich.						.65@1.00
Gainesville, Texas						.55
Grand Haven, Mich.						.70@ .90
Grand Rapids, Mich.				.60		
Hamilton, Ohio					.70	
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, at .65			
Joliet, Plainfield and Hammond, Ill.	.35	1.25				
Lindsay, Texas						.55
Macon, Ga.	.35	.35				
Mankato, Minn.			Pit run sand, .70			
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronts and Yorkville, Ill.			Ave. .60 per ton all sizes			
Somerset, Penn.		1.85@2.00		1.50@1.75		
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Shining Point, Penn.			Concrete sand, 1.10 ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.10	1.00				

(a) ⅝ in. down. (b) River run. (c) 2½ in. and less.
*Cubic yd. †Include freight and bunkerage charges and truck haul. ‡Delivered on job.
(d) Less 10c per ton if paid E.O.M. 10 days. (e) pit run. (f) plus 15c winter loading charge

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.				.30@ .35			
Albany, N. Y.	2.00	2.00	2.25			3.75	
Arenzville, Ill.	1.50@1.75			1.00			
Beach Sity, Ohio	1.75@2.00	1.75@2.00		1.75@2.25	1.75@2.50		
Buffalo, N. Y.	1.50	1.50		2.00@2.50			
Columbus, Ohio	1.25@2.00	1.25@1.75	2.00@2.50	.30@1.50	2.00@2.50	2.75@3.50	1.50@3.00
Dresden, Ohio	1.40	1.50	1.50	1.25	1.50		
Eau Claire, Wis.						3.00	
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Elnora, N. Y.			1.75				
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Penn.	1.75	1.75	2.00	1.75			
Kasota, Minn.							1.10a
Klondike, Mo.	1.75		1.75	1.75	1.75		1.75
Mapleton Depot, Penn.	2.25	2.00		2.00	2.00	2.25	
Massillon, Ohio	2.50	2.50		2.50	2.50		
Mendota, Va.	Ground flint or silex—16.00@20.00 per ton						
Michigan City, Ind.				.20@ .30	.30		
Montoursville, P'n.				1.25@1.35			
Ohlton, Ohio	1.80	1.80	1.80	2.00	1.80	1.80	1.80
Ottawa, Ill.	2.50		2.50	1.25	.75	3.50	3.50
Red Wing, Minn.	1.25		1.25	1.50	1.50	3.50	1.50
Ridgeway, Penn.	1.50	1.50					
Round Top, Md.		1.25		1.60		2.25	
San Francisco, Calif.	3.50	4.75	3.50	3.50@5.00	3.50@4.50	3.50@5.00	
Tamalco, Ill.		1.40@1.60					
Tamms, Ill.	Ground silica per ton in carloads—20.00@31.00						
Thayers, Penn.	1.25	1.25		2.00			
Utica, Ill.¶		.50@.85	.50@.90	.60@.75	.60@.90		
Utica, Ill.	.60	.65@ .85		.65	.75		
Utica, Penn.	1.75	1.75		2.00			
Zanesville, Ohio	2.00	1.50	2.00	2.00	2.00		

*Green. †Crude silica, crushed and screened, not washed or dried. ‡Plus 75c per ton for winter loading. ¶Crude. §Crude and dry. (a) delivered.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium and Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern, N. J.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
Reading, Pa.	2.50	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.30*	1.80*	1.45*	1.45*	1.45*	1.45*
Jackson, Ohio		1.05*		1.30*	1.05*	1.30*	1.30*
Toledo, Ohio	1.50	1.35	1.35	1.35	1.35	1.35	1.35
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.		1.55*		1.55*	1.55*	1.55*	1.55*
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruessens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00					2.15e
Buffalo, N. Y.		12.00	12.00	12.00			10.00	1.95d
Chazy, N. Y.	12.50	10.50	8.00	12.00	11.50	16.50	10.00	2.50z
Lime Ridge, Penn.					5.00a			
West Stockbridge, Mass.	12.00	10.00	5.60					2.00t
Williamsport, Penn.			10.00				6.00	
York, Penn.		9.50	9.50	10.50	8.50	10.50	8.50	1.65i
CENTRAL:								
Carey, Ohio	12.50	8.50	8.00		9.00		8.50	1.50
Cold Springs, Ohio	12.50	8.50	8.50		9.00		8.00	
Delaware, Ohio		8.50	8.50	8.50	7.50	.67½	7.50	1.50
Frederick, Md.		10.00	10.00	10.00	8.50	10.00	7.00	
Gibsonburg, Ohio	12.50	8.50	8.50		9.00	11.00	8.50	
Huntington, Ind.	12.50	8.50	8.50		9.00		8.00	
Luckey, Ohio	12.50							
Marblehead, Ohio		8.50	8.50		9.00		8.00	1.50w
Marion, Ohio		8.50	.850				8.00	1.70d
Milltown, Ind.		9.00@10.00		10.00p			8.50q	1.40r
Sheboygan, Wis.	11.50						9.50	.95
Tiffin, Ohio					9.00			
White Rock, Ohio	12.50				9.00	11.00	8.00	
Wisconsin points (f)		11.50					9.50	
Woodville, Ohio	12.50	.850	.850		9.00	11.00	9.00	1.50
SOUTHERN:								
Allgood, Ala.	12.50	10.00			8.50		8.50	1.50
El Paso, Tex.	22.50						8.00	
Graystone, Ala.	12.50	10.00				1.45e	8.50	1.50
Keystone, Ala.		10.00	10.00	10.00	8.50	1.45u	8.50	1.50
Knoxville, Tenn.	20.25	10.00	10.00	10.00			8.50	1.50
Longview, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
Ocala, Fla.	14.00	13.00	12.00	13.00			12.00	1.70
Saginaw, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
WESTERN:								
Calcite, Colo.							9.25	
Kirtland, N. M.							15.00	
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Dittlinger, Tex.		12.00@13.00					9.50p	1.50s
San Francisco, Calif.	21.00	19.00	16.50				14.00	2.00
Tehachapi, Calif.			8.00				13.00z	2.20x
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

†50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) steel; (e) per 180-lb. barrel; (f) dealers' prices, net 30 days less 25c disc. per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days; (i) 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65; (p) to 11.00; (q) to 8.75; (r) to 1.50; (s) in 80-lb. burlap sacks; (t) to 3.00; (u) two 90-lb. bags; (v) oil burnt; wood burnt 2.25@2.50; (x) wood, steel 2.30; (z) to 13.00; (*) quoted f.o.b. New York; (‡) paper bags; (w) to 1.50 in two 90-lb. bags, wood bbl. 1.60; (1) to 10.00; (3) 80-lb. paper bags; (2) to 3.00; (5) to 9.00; (4) to 1.60. (8) to 16.00; (e) wood bbl., steel, 1.80.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Gray Summit and Klondike, Mo.		1.75
Mapleton Depot, Penn.	2.00	2.00
Massillon, Ohio		2.25
Michigan City, Ind. (Engine sand)		.15@ .25
Mineral Ridge, Ohio	*1.75	*1.75
Montoursville, Penn.		1.25
Ohlton, Ohio	1.80	1.80
Ottawa, Ill.	1.25	
Red Wing, Minn.		1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50@ 4.50	3.50@ 4.50
Thayers, Penn.		2.25
Utica, Ill.	1.00@ 3.00	1.00
Warwick, Ohio		2.25
Zanesville, Ohio		2.50

*Wet.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point,

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons, per gross	1.00@ 1.50
Chatsworth, Ga.:	
Crude Talc	5.00
Ground (150-200 mesh), bulk	10.00
Pencils and steel worker's crayons, per gross	1.00@ 2.00
Chester, Vt.:	
Ground talc (150-200 mesh), bulk	9.00@10.00
Including bags	10.00@11.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc	5.00
Ground talc (150-200) bags	10.00@12.00
Pencils and steel workers' crayons, per gross	1.00@ 1.50
Emeryville, N. Y.:	
(Double air floated) including bags;	
325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 300-350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.50
Ground talc (150-200 mesh), bulk	9.00@14.50
Joliet, Ill.:	
Roofing talc, bags	10.00
Ground talc (200 mesh), bags	30.00
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (300 mesh), bags	13.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 5.00
Mt. Pleasant, Tenn.—B.P.L. 75%	5.50@ 6.00
Tennessee—F.O.B. mines, gross ton, unground brown rock, B.P.L. 72%	5.00
B.P.L. 75%	6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	8.00@ 9.00

Ground Rock

(2000 lbs.)

Centerville, Tenn.—B.P.L. 65%	7.00
Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 65%	8.00@10.00
Twomey, Tenn.—B.P.L. 65%	8.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton.)

Florida—F. O. B. mines, gross ton,	
68/66% B.P.L., Basis 68%	3.25
70% min. B.P.L., Basis 70%	3.75
72% min. B.P.L., Basis 72%	4.25
75/74% B.P.L., Basis 75%	5.25
77/76% B.P.L., Basis 77%	6.25

Mica

Prices given are net, F.O.B. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton	125.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, N. H. — per ton,	
mine run	360.00
Mine scrap	22.00
Clean shop scrap	25.00
Roofing mica	35.00
Dry ground, 20 mesh	35.00
40 mesh	40.00
60 mesh	45.00
200 mesh	65.00
Punch mica, per lb.	.10

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars	.....	10.50
Brandon, Vt.—English pink and English cream	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.—Pink..	6.00	5.00
Mixed pink and bronze	4.50@ 6.00	4.50@ 6.00
All colors, mixed sizes	3.50	3.50
Buckingham, Que.—Buff stucco dash	.....	‡12.00@14.00
Chicago, Ill. — Stucco chips, in sacks f.o.b. quarries	.....	17.50
Crown Point, N. Y.—Mica Spar	.....	9.00@10.00
Dayton, Ohio	.....	6.00@24.00
Easton, Penn., and Phillipsburg, N. J.	10.00@16.00	10.00@16.00
Haddam, Conn. — Felstone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio — Concrete facings and stucco dash	.....	6.00@18.00
Middlebrook, Mo.—Red	.....	25.00@30.00
Middlebury, Vt.—Middlebury white	.....	*9.00
Marble flour, 100% thru 80 mesh	.....	3.50
Crusher run marble	.....	3.50
Milwaukee, Wis.	.....	14.00@34.00
Newark, N. J.—Roofing granules	.....	7.50
New York, N. Y.—Red and yellow Verona	.....	32.00
Red Granite, Wis.	.....	7.50
Stockton, Calif. — "Natrock" roofing grits	.....	15.00@20.00
Tuckahoe, N. Y.—Tuckahoe white	12.00	12.00
Wauwatosa, Wis.	.....	20.00@32.00
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00

†C.L. L.C.L. 17.00.
*C.L. including bags; L.C.L. 14.50
‡C.L. including bags, L.C.L. 10.00.

Potash Feldspar

Auburn and Brunswick, Me.—Color, white; 98% thru 140 mesh bulk	19.00
Buckingham, Que.—Color, white; analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white; bulk (crude)	9.00
East Hartford, Conn.—Color, white, 95% through 60 mesh, bags	16.00
96% thru 150 mesh, bags	23.00
East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Erwin, Tenn.—Color, white; analysis, 12.07% K_2O, 19.34% Al_2O_3; Na_2O, 2.92%; SiO_2, 64.76%; Fe_2O_3, .36%; 98.50% thru 200 mesh, bags, 16.90; bulk	15.50
Glen Tay Station, Ont., color, red or punk; analysis: K_2O, 12.81%, crude (bulk	6.75@ 7.00
Keystone, S. D.—Prime white, bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 10.35%; Na_2O, 3.62%; Al_2O_3, 18.71%; SiO_2, 65.48%; Fe_2O_3, .17%; 95% thru 200 mesh, bags included, carloads	22.00
Bulk	20.00
Murphsboro, Ill.—Color, snow white; analysis SiO_2, 64.4%; K_2O, 13%; Na_2O, 2.5%; Fe_2O_3, 0.07%; Al_2O_3, 19.3%; 98% thru 200 mesh, bags	21.00
Bulk	21.00
Penland, N. C.—Color, white; crude, bulk	8.00
Ground, bulk	16.50
Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O_3, 10%; 68% SiO_2; 99% thru 200 mesh; bulk	18.00
99% thru 140 mesh, bulk	16.00
Toughkenamon, Penn.—Color, cream; 90% thru 200 mesh, bags 14.00, bulk	10.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00
Trenton, N. J.—Crude, bulk	12.00@27.00
99% thru 140 mesh; bulk	16.00

(Bags 11 cents each, non-returnable)

Blended Feldspar

(Pulverized)

Tenn. Mills—Bulk ..... 16.00@20.00

Chicken Grits

Afton Mich. (limestone) per ton	10.00
Belfast and Rockland, Me.—(Limestone), bags, per ton	‡10.00
Brandon and Middlebury, Vt., per ton	12.00‡
Centerville, Iowa (gypsum) per ton	18.00
Chico, Texas (limestone), 100 lb. bags, per ton	8.00@ 9.00
Danbury, Conn. (limestone)	7.00@ 9.00
Knoxville, Tenn. (limestone), bags, per ton 7.00; bulk	5.00
Los Angeles Harbor (limestone), 100-lb sack, 1.00; sacks, per ton, 8.50@ 9.50†; bulk, per ton	6.00@7.00†
Gypsum, Ohio.—(Gypsum) per ton	10.00
Limestone, Wash. (limestone) per ton	12.50
Rocky Point, Va. (limestone) 100 lb. bags, 75c; sacks, per ton, 6.00 bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	12.50
Warren, N. H.—(Mica) per ton	7.70@7.90‡
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone) bulk	7.50@9.00*

*L.C.L.
†Less than 5-ton lots.
‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass.	*17.00
Brighton, N. Y.	*19.75
Dayton, Ohio	12.50@13.50
Detroit, Mich.	15.00@17.50
Farmington, Conn.	13.00
Flint, Mich.	¶12.50@16.00
Grand Rapids, Mich.	12.00
Hartford, Conn.	*19.00
Jackson, Mich.	12.25
Lancaster, N. Y.	12.50
Madison, Wis.	a12.00
Michigan City, Ind.	11.00
Milwaukee, Wis.	*13.00
Minneapolis and St. Paul, Minn.	11.25
Minnesota Transfer	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	12.00@13.50
Portage, Wis.	15.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	*19.75
Saginaw, Mich.	13.00
San Antonio, Texas	15.00
Sebewaing, Mich.	11.50
Syracuse, N. Y.	18.00@20.00*
Toronto, Canada	13.00@15.60†
Toronto, Canada	13.10
Wilkinson, Fla.	10.00@12.00

*Delivered on job. †Sales tax included.
‡Less 5%. ¶Dealers' price. (a) Less 1.00 E.O. M. 10 days.

Portland Cement

Prices per bag and per bbl, without bags net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.	.....	3.37
Atlanta, Ga.	.....	2.35
Baltimore, Md.	.....	2.15
Birmingham, Ala.	.....	2.30
Boston, Mass.	.....	2.53
Buffalo, N. Y.	.....	2.28
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa	.....	2.34‡
Charleston, S. C.	.....	2.35
Cheyenne, Wyo.	.82¾	3.31
Cincinnati, Ohio	56¾	2.37‡
Cleveland, Ohio	.....	2.29‡
Chicago, Ill.	.....	2.10‡
Columbus, Ohio	.....	2.24
Dallas, Texas	.....	2.10
Davenport, Iowa	.....	2.29‡
Dayton, Ohio	.57	2.28
Denver, Colo.	.66¼	2.65
Detroit, Mich.	.....	2.15‡
Duluth, Minn.	.....	2.09‡
Houston, Texas	.....	2.60
Indianapolis, Ind.	.....	2.19
Jackson, Miss.	.....	2.50
Jacksonville, Fla.	.....	2.20
Jersey City, N. J.	.....	2.23
Kansas City, Mo.	.....	1.92
Los Angeles, Calif.	.61†	2.44†
Louisville, Ky.	.54¼	.....
Memphis, Tenn.	.....	2.60‡
Milwaukee, Wis.	.....	2.25‡
Minneapolis, Minn.	.....	2.32‡
Montreal, Que.	.....	1.36
New Orleans, La.	.....	2.20
New York, N. Y.	.....	2.15
Norfolk, Va.	.....	2.07
Oklahoma City, Okla.	.....	2.46‡
Omaha, Neb.	.....	2.36‡
Peoria, Ill.	.....	2.27‡
Philadelphia, Penn.	.....	2.31
Phoenix, Ariz.	.....	2.91
Pittsburgh, Penn.	.....	2.09‡
Portland, Colo.	.....	2.80
Portland, Ore.	.....	2.60
Reno, Nevada	.75¼	3.01
Richmond, Va.	.....	2.34
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.	.....	2.31‡
Savannah, Ga.	.....	2.50
St. Louis, Mo.	.55	2.20‡
St. Paul, Minn.	.....	2.32‡
Seattle, Wash.	10c discount	2.50
Tampa, Fla.	.....	2.25
Toledo, Ohio	.....	2.20‡
Topeka, Kans.	.....	2.41‡
Tulsa, Okla.	.....	2.33‡
Wheeling, W. Va.	.....	2.07
Winston-Salem, N. C.	.....	2.78

NOTE—Add 40c per bbl. for bags.
†Delivered on job in any quantity, sacks extra.
‡Ten cents less to dealers.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Buffington, Ind.	.....	1.85
Chattanooga, Tenn.	.....	2.45*
Concrete, Wash.	.....	2.35
Davenport, Calif.	.....	2.05
Detroit, Mich.	.....	2.15
Hannibal, Mo.	.....	2.05
Hudson, N. Y.	.....	1.95
Leeds, Ala.	.....	1.95
Mildred, Kans.	.....	2.35
Nazareth, Penn.	.....	1.95
Northampton, Penn.	.....	1.95
Richard City, Tenn.	.....	2.05
Steelton, Minn.	.....	1.90
Toledo, Ohio	.....	2.20
Universal, Penn.	.....	1.85

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ⅜x32x 36". Wt. 1500 lb. Per M Sq. Ft.	½x32x 36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev. and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u	.....	.....	.....	.....	11.70u	.....	.....	.....
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50	.....	.....	13.50	.....	.....	.....
Detroit, Mich.‡	.....	.....	.....	11.30	11.30	11.30	.....	8.00	.....	.....	.....	.....	.....
Delawanna, N. J.	——	——	——	——	——	8.00	.....	8.25@9.40	.....	.....	.14½s	.15½s	40.00@41.00
Douglas, Ariz.	.....	.....	7.00	.....	.....	15.50d	18.50	.....	30.00	15.50	.....	.....	——
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50	.....	24.55	20.00	.....	.....	——
Gypsum, Ohio‡	3.00	4.00	6.00	8.00	9.00	9.00	18.00	7.00	27.00	19.00	.....	15.00	30.00
Los Angeles, Calif.	.....	.....	.....	8.65r	.....	.....	.....	.....	.....	.....	.....	.....	.....
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00	.....	20.00	30.00
Portland, Colo.	.....	.....	.....	10.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco, Cal.	.....	.....	.....	14.00	14.40	15.40	.....	15.40	.....	.....	.....	.....	.....
Seattle, Wash.	6.50	.....	11.00	16.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sigurd, Utah	.....	.....	.....	.....	.....	.....	.....	.....	21.50	.....	.....	.....	.....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	.....	.....	.....	.....	20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
*To 3.00; †to 11.00; ¶to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00; (b) net; (c) gross; (d) hair fibre; (f) delivered; (h) delivered in six states; (i) delivered on job; (k) sacks 12c extra, rebated; (m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board; (t) to 16.50; (u) includes sacks; (v) F.O.B. N. Y. C. and dealers yard in mill locality.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City of shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00	.....	.....
Columbus, Ohio	.16@.18a	.....	.....
Detroit, Mich.	.16	.....	.18
Forest Park, Ill.	18.00*	23.00*	30.00*
Grand Rapids, Mich.	.15	.....	.....
Graettinger, Iowa	.18@.20	.....	.....
Indianapolis, Ind.	.14@.16†	.....	.....
Los Angeles, Calif.¶	5¾x3½x12—55.00	7¾x3½x12—65.00	
Oak Park, Ill.	.18@.21a	.....	.....
Olivia and Mankato, Minn.	9.50b	.....	.....
Somerset, Penn.	.20@.25	.....	.....
Tiskilwa, Ill.	.16@.18†	.....	.....
Yakima, Wash.	20.00*	.....	.....

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton.

Cement Roofing Tile

Prices are net per sq. in carload lots, f.o.b. nearest shipping point unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

Red	15.00
Green	18.00
Chicago, Ill.—per sq.	20.00

Cicero, Ill.—Hawthorne roofing tile, per sq.

	Chocolate Red and Orange	Yellow, Tan Green and Slate Blue	Gray
French and Spanish†	$11.50	$13.50	$12.75
Ridges (each)	.25	.35	.30
Hips	.25	.35	.30
Hip starters	.50	.60	.60
Hip terminals, 2-way	1.25	1.50	1.50
Hip terminals, 4-way	4.00	5.00	5.00
Mansard terminals	2.50	3.00	3.00
Gable finials	1.25	1.50	1.50
Gable starters	.25	.35	.30
Gable finishers	.25	.35	.30
*End bands	.25	.35	.30
*Eave closers	.06	.08	.06
*Ridge closers	.05	.06	.05

*Used only with Spanish tile.
†Price per square.

Houston, Texas.—Roofing Tile, per sq.	25.00
Indianapolis, Ind.—9"x15"	
Gray	10.00
Red	11.00
Green	13.00
Waco, Texas:	Per sq.
4x4	.60

Cement Building Tile

Cement City, Mich	Per 1000
5x8x12	55.00
Detroit, Mich.	Per 100
5x4x12	4.50
5x8x12	8.00
Longview, Wash. (Stone-Tile)	Per 1000
3½x6x12	60.00
3½x8x12	65.00
Mt. Pleasant, N. Y.:	**Per 1000**
5x8x12	78.00
Grand Rapids, Mich.:	**Per 1000**
5x8x12	70.00
Houston, Texas:	
5x8x12 (Lightweight)	80.00
Pasadena, Calif.—(Stone Tile	Per 100
3½x4x12	3.00
3½x6x12	5.00
3½x8x12	6.00
Tiskilwa, Ill.—8x8, per 100	15.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile)	Per 1000
3½x6x12	50.00
3½x8x12	60.00
Prairie du Chien, Wis.	14.00 22.50@27.00
Yakima, Wash.—Building tile:	
5x8x12	.10

Cement Drain Tile

Graettinger, Iowa drain tile per 100 ft.	
5-in.	4.50
6-in.	5.60
8-in.	9.00
10-in.	12.00
12-in.	17.50
14-in.	25.00
16-in.	35.00
18-in.	45.00
20-in.	60.00
22-in.	70.00
24-in.	80.00
30-in.	100.00
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waukesha, Wis.—Drain tile, per ton	**9.00**

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	30.00@35.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	
Ensley, Ala. ("Slagtex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.	18.00	
Milwaukee, Wis.	14.00@15.00	30.00@75.00
Mt. Pleasant, N. Y.		14.00@23.00
Omaha, Neb.	18.00	30.00@40.00
Pasadena, Calif.	12.50	
Philadelphia, Penn.	15.00	20.00
Portland, Ore.	17.00	25.00@75.00
Prairie du Chien, Wis.	14.00	22.50
Rapid City, S. D.	18.00	25.00@40.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Wauwatosa, Wis.	14.00	21.00@42.00
Westmoreland Wharves, Penn.	15.00	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	

†Gray. ‡Red.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								15.00 per ton									
Graettinger, Iowa	.04½d	.05½	.08½	.12½	.17½	.....	.40	.50	.60	.70	.....	.....	.....	.....	.....	.....	.....
G'd Rapids, Mich. (b)	.....	.....	.....	.60	.72	1.00	1.28	.....	.....	1.92	2.32	3.00	4.00	5.00	6.00	.....	.....
Houston, Texas	.....	.19	.28	.43	.55½	.90	1.30	.....	†1.70	2.20	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind. (a)	.....	.....	.....	.80	.90	1.10	1.30	.....	.....	1.70	.....	2.70	.....	.....	.....	.....	.....
Longview, Wash.							Sewer pipe 40% off list, culvert—list										
Mankato, Minn. (b)	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.50	1.75	2.50	3.25	4.25	.....	.....	.....
Newark, N. J.								6 in. to 24 in., $18.00 per ton									
Norfolk, Neb.	.....	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	7.78
Olivia, Mankato, Minn.								12.00 per ton									
Paullina, Iowa‡	.....	.....	.....	.....	.....	.....	.....	2.25	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Somerset, Penn.	.....	.....	.....	.....	1.08	1.25	1.65	.....	.....	2.50	.....	3.65	4.85	7.50	8.50	.....	.....
Tacoma, Wash.	.15	.17	.22½	.30	.40	.55	.70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tiskilwa, Ill. (rein.) (a)	.....	.....	.....	.65	.75	.85	1.10	1.60	.....	1.90	.....	2.25	3.40	.....	5.50	.....	.....
Wahoo, Neb. (b)	.....	.....	.....	.....	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	4.62	6.14	6.96	7.78
Waukesha, Wis.								12 in. to 60 in. 18.00 per ton									
Yakima, Wash.								$10.00 per ton									

*30-in. lengths up to 27-in. diam., 48-in. lengths after; (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced.
†21-in. diam. ‡Price per 2 ft. length. (d) 5 in. diam. [1]@1.08 [2]@1.25. [3]@1.65. [4]@2.50. [5]@3.85. [6]@5.00. [7]@7.50.

Cinder Block Plants Merge

THE Washington Concrete Products Co., located in South Washington, Va., and 17 other cinder concrete block manufacturing companies in New York, New Jersey, Pennsylvania, Ohio and Michigan were consolidated into the National Building Units Corp. recently at New York. Some of the companies identified with the new organization include the Philadelphia Partition and Building Block Co., Philadelphia; Concrete Specialties Co., Camden, N. J.; Lancaster Concrete Tile Co., Lancaster, Pa.; Harrisburg Building Block Co., and the Pennsylvania Concrete Roofing Tile and Cement Products Co., both of Harrisburg, Pa.

L. A. Good of Camden, N. J., was made president and George L. Benbow of Philadelphia, vice-president. H. A. Davis, general manager of the Washington company, was named as a director. The plans include a capital of approximately $2,000,000, and issuance of 25,000, 7% cumulative and 350,000 shares of no par value stock.—*Washington (D. C.) Post.*

To Manufacture Concrete Mantels

ESTABLISHMENT of a Woodward One-Piece Mantel Co. branch office and manufacturing plant at Jacksonville, Fla., was announced recently by Tudor & White, manufacturers of the product. Production will begin immediately, it is said.

The company's product is a one-piece concrete mantelpiece of any design, finish or color. The piece is made by a patented method and is manufactured at a less cost than the common brick mantel.

The mantels manufactured through the Woodward method are guaranteed by the manufacturer not to break, chip or fade. They can be made in style or color to suit the architectural design or color scheme of all rooms.—*Jacksonville (Fla.) Tribune.*

Safety Course Instituted

SAFETY engineering is now recognized as a profession, but what is said to be the first collegiate course in accident prevention is to be offered shortly by the New York University in cooperation with the American Museum of Safety.

Improved Signal Mountain Plant

THE cement mill of the Signal Mountain Portland Cement Co., at Chattanooga, Tenn., began production in December, 1923. At that time two kilns were put in operation and the production was about 3000 bbl. per day. Provision was left in the plans for easy expansion to about four times the size. The crushing equipment was sufficient to take care of such an increase and the raw and finish grinding plant adequately equipped for a four-kiln plant. A description of the mill as it appeared in the first days of operations was published in the December 29, 1923, issue of Rock Products.

The general demand for portland cement in the southern states during recent years has necessitated the completion during the past few months of more than a half million dollars of improvements. These include the installation of a new kiln and grinding equipment, increasing the capacity from 1,000,000 to 1,500,000 bbl. per year.

The new kiln is similar in size to the two installed at the time of the erection of the plant. They are 11x175 ft. each with the accompanying rotary cooler 8x70 ft.

Two new Allis-Chalmers compeb mills were installed in the raw department and two similar installations made in the finish department. All four of these mills were 7 ft. in diameter by 36 ft. in length and are operated by 500 hp. synchronous motors.

The capacity of the crushing department was also increased by the installation of a No. 6 Williams mill served by a 60-ft. rock elevator from the crusher.

Improvements also included an extension to the main storage of 100 ft. in length increasing the capacity of the raw material storage by 15%. A new set of six silos for cement storage were also constructed, increasing the storage capacity by 100,000 bbl. A Fuller-Kinyon system was installed for conveying the finished product.

Extensive developments were also continued in the quarry and several new quarry cars and other equipment added.

Other improvements include a new office building at the plant site, garage and oil and motor repair storage. The office was formerly located in the James Bldg. at Chattanooga. The new improvements in construction were made by the Cowham Engineering Co., Chicago.

National Cement of Canada to Add Fourth Kiln

ACCORDING to a recent announcement the National Cement Co., Montreal, is planning to increase the capacity of its mill at Montreal East by about one-third, by adding another kiln unit to the three already in operation. The present output is about 990,000 bbl. and after installation of the new unit this will be raised to about 1,320,000 bbl. annually. It is expected that work on the addition will start within a short time.

The Montreal East plant of the National Cement Co. was completed early this year and is unusual in that it is the first dry process plant to be constructed within the past 3 years. A complete description was published in Rock Products, January 9 issue. The original plant design left allowance for doubling the capacity without disturbing the present layout and includes waste-heat boilers and power plant should they be desirable at any future time. The addition of the fourth kiln will be the first since the completion of the plant.

The present intention is to carry out the expansion without recourse to public financing. This is largely due to the fact that the unit can be added at comparatively low cost, as the installation involves construction of the kiln proper only, and the subsequent tuning-up of the new unit with the three old ones now in operation.

It is reported that up to the present time the company has had no trouble in disposing of its production. It has been found impossible to fill all orders, as the demand has been in excess of actual output. One reason for this situation is that, in Montreal particularly, conditions have been highly favorable to the cement industry. In the first six months of the present year, Montreal has led all Canadian cities in volume of new construction.

The officers of the company are Joseph Versailles, president; Donat Raymond, vice-president, and Lucien Hamel, secretary-treasurer. L. C. Atkinson is superintendent and Richard K. Meade, consulting engineer.

View of Signal Mountain Portland Cement Co.'s mill at Chattanooga, Tenn., after addition of new equipment which increased the capacity from 3000 to 5000 bbl. per day

New Machinery and Equipment

Struck Measuring Hopper for Batching Aggregates

A STRUCK measuring hopper for batching of aggregates, to be used in conjunction with a loader, is announced by the Link-Belt Co., Chicago, Ill. The hopper as used with the Link-Belt "Grizzly" loader has a strike-off chute which is supported on a steel frame and can be either belted or hinged to the frame of the loader. The hinge arrangement is the one recommended by the company, because it allows the hopper to be turned out of the way to allow the elevator frame to be lowered and reduces the over-all height of the loader about 30 in. for travel under low bridges, etc.

The measuring hopper has an interlocking lever system which, it is said, is to prevent material discharge from the hopper before being struck off and eliminate possibility of the return of the strike-off chute before the gate is closed. A return chute, provided for all material that is struck off by the strike-off chute, also acts as a means of telling when the hopper is full, for the operator, it is said, can see the excess material returning on the lower chute to the foot of the elevator. The opening of the hopper gate, it is said, is facilitated by the weight of the material handled, and is accomplished by lifting one end of a notched operating bar. To close the hopper, the bar is pulled back until the notch is engaged and latched into place.

The capacity of the hopper is varied, it is said, by a false bottom inside of the hopper flanged on two edges to give place for bolt holes and to add stiffness to the plate. The upper end of this plate is raised or lowered by means of two flats, one on either side of the hopper, to which the plate is bolted. These bolts slide in slots in the sides of the hopper. Two angle clips, fastened to the hopper bottom on outside, receive bolts that hold the flats in place. To vary capacity, all that is required is to change position of flat in relation to the hole in the angle clip. Batch size variations from ½ cu. ft. to 23 cu. ft. can be obtained by removing two bolts and inserting them in other holes.

Loader equipped with struck measuring hopper for batching aggregate

An Efficient Oil Burner

A POWERFUL burner for preheating castings before welding, straightening plates, making shrunk fits, melting brass and like work is a handy thing to have about the repair shop of any rock products plant. It

Kerosene or distillate fired burner for repair work

is almost essential to have one in connection with a welding outfit.

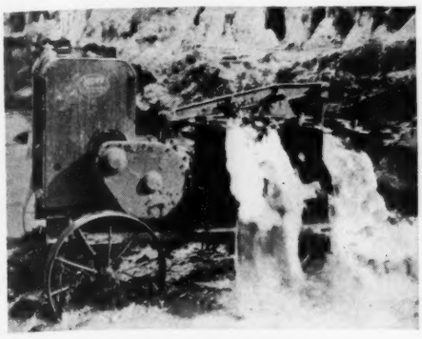
The Alexander Milburn Co. of Baltimore, Md., makes such a burner in which the cheaper fuels such as kerosene and distillate may be used. It works without preheating. All that is necessary is to open the valve and touch a match to the vapor.

This burner, the manufacturer says, works on the atomizing principle, pressure forcing the oil into an annular chamber from which it issues at right angles to the outlet. Compressed air flows through the chamber striking the film of oil at right angles and atomizing it. The oil vapor is then expanded in a venturi shaped outlet. It is claimed that there is no siphoning effect of either air or fuel and that no oil is blown through the flame unconsumed.

The outfit, which consists of a steel reservoir, a burner, two lengths of hose and air and oil pipe feed lines, is furnished in three sizes. The smallest has 5 gal. oil capacity and is used for light work. The largest has 22 gal. oil capacity and is used for heavy work. Burners are interchangeable and may be used with any size tank.

Portable Pumping Outfit

A PORTABLE combination of gas engine and pump that might be used for pumping in quarries and other places where it would not require to be permanently installed



Combination gas engine and pump

is shown in the accompanying cut. It is made by the Novo Engine Co. of Lansing, Mich. The pump is the double force diaphragm variety and the engine is a 3 to 6 hp. Novo with Timken bearings. The makers say that it will operate against a total head of 50 ft., which includes the suction lift. The rating is from 16,000 to 20,000 gallons per hour.

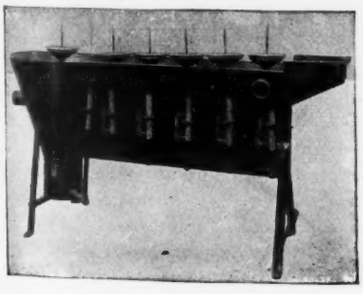
New Hydraulic Classifier

THE Dorr Co., engineers, 247 Park avenue, New York, has recently announced that it has taken over the manufacturing and selling of the Fahrenwald Sizer, an hydraulically operated machine that was developed after a long series of tests by A. W. Fahrenwald of the United States Bureau of Mines.

The applications of the sizer may be briefly summed up as follows:

It will take an unsized feed in which the particles are of uniform specific gravity and deliver a number of closely sized products.

It will take an unsized feed in which the particles are not of uniform specific gravity



Automatic hydraulic sizer

and will deliver a series of hydraulically classified products.

It will take a sized feed in which the particles are not of uniform specific gravity, and separate the particles according to specific gravities, or in other words, make a concentration.

The sizer is a six pocket machine, the compartments having straight, non-sloping sides so that the velocity of the hydraulic water is uniform over the whole area. The spigot discharge valve is controlled by a diaphragm, sensitive to every change of conditions in the classifying pockets, and this automatically insures uniform quality of the spigot products.

Very little hydraulic water is required, and once adjusted the sizer is automatic in operation and will even start up after a shutdown without supervision.

It is a light, compact machine, taking little floor space, is easily handled and simple to install.

Improved Portable Conveyor

THE Jeffrey Manufacturing Co. of Columbus, Ohio, has recently put on the market an improved type of portable belt conveyor for handling sand, gravel, crushed stone and similar materials.

The improvements are designed around the idea of providing a machine more suitable for building material yards and industrial

Conveyor for handling material to and from storage piles

plants where it is desired to handle materials from hopper-bottom railroad cars to storage piles or trucks, and for reclaiming from storage piles.

The new features pointed out by the manufacturers are:

1. Steel side boards which are bent to extend under the side of the belt, forming with the belt a moving trough which provides larger capacity and prevents lumps from rolling off.

2. An improved type of carrying idler to support the loaded portion of the belt.

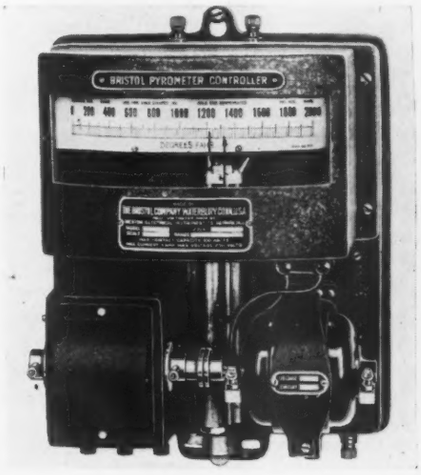
3. An extended and flared loading leg at the bottom, edged with belting material to form a seal with the moving belt. The flared hopper also centers the load on the conveyor.

4. An efficient gate at the foot of the conveyor to prevent material from falling into the enclosed boot housing.

This conveyor is built in 18, 24 and 30 ft. lengths and is furnished with electric motor or gasoline engine. Belt furnished is 16-in. rubber covered, troughed.

New Pyrometer Controller

THE Bristol Co., Waterbury, Conn., has added to its line of pyrometric equipment, model 479, a pyrometer controller in which many new features are said to have



New pyrometer with extra wide scale

been incorporated. The instrument will register up to 3000 deg. F. and is equipped with an extra wide scale which permits easy reading. It is operated by a motor drive and all working parts are accessible for adjustment and oiling.

The motor, with horizontal axle, is connected to the driving shaft by means of a non-metallic coupling. The governor used to regulate the speed of the driving motor is said to be reliable and positive in its operation and all parts of the governor mechanism and gears accurately aligned and doweled to maintain permanent adjustment.

As a result of relative adjustment of the plane of travel of the switch and the millivoltmeter movement, the switch is said to operate with certainty at any part of the scale arc. The complete moving mechanism which supports the switch is assembled in one unit, which unit is supported rigidly in a bearing having a total area of about 4.5 sq. in. and is 6 in. long. It is claimed that once the mechanism is set up there can be no variation in adjustment, regardless of the position of the switch.

An improvement in the construction of the controller is said to lie in the safety adjusting mechanism, for setting the position of the index at the point to which it is desired to bring the temperature.

A small hinged cover is used to enclose the adjusting knob. This knob cannot be operated until the cover is opened, and the act of opening the cover automatically forces the switch mechanism to its lowest position, where it is entirely free from the pointer.

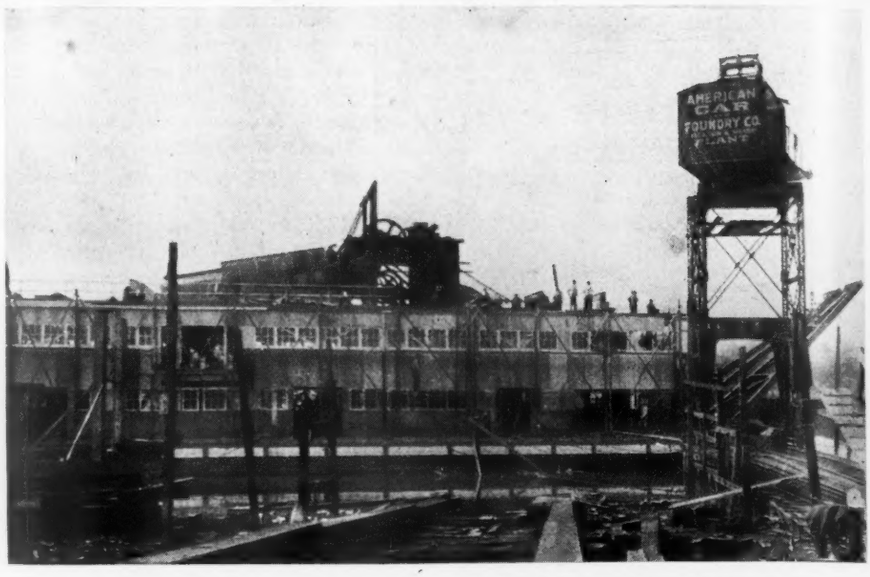
Tests made with this new controller are said to prove that a movement of the pointer which is too small to be observed with the naked eye, will decide whether contact is made on the high or low side. This extremely close operation, it is claimed, eliminates the need for partial or setback scales.

"Magic City" Arrives at Florida

ON August 21 the dredge *Magic City* arrived at Miami, Florida, after a long tow from Wilmington, Del., which began August 5. Two powerful tugs drew the big dredge which was so heavy a load that a speed of five miles per hour was all that could be made.

The *Magic City* was described as it was being constructed in an editorial letter published in the issue of May 29. It is almost if not quite unique among dredges in the rock products industry, as it is a ladder dredge designed to dig rock and not sand and gravel. In addition to the washing and screening equipment found on gravel dredges it contains primary and secondary crushers. The rock is coral rock and the dredge is expected to have a capacity of 5000 tons per 10-hour day. Power is furnished by a 500 hp. Diesel engine. It has full living quarters for the crew and a galley fitted with every modern convenience, including electric refrigeration.

The dredge was built for the Meteor Trading and Transportation Co. of Miami, Fla., a corporation with which Charles Warner, head of the Charles Warner Co., is associated. It was constructed by the American Car and Foundry Co., of Wilmington, Del., and the picture was taken at this company's yards about a month before the dredge started on its voyage. It was designed by the Charles Warner Co.'s engineers and built under the supervision of Irving Warner. J. Gilmore Wilson, assisted by Frank Wilson, had direct charge of the construction work.



Dredge "Magic City" lying at the dock of the builders' yards in Wilmington, Del.

Quarry Operation Halted by Injunction

THE temporary injunction granted the D. T. & I. railroad against the National Quarries Co. in the litigation arising over Henry Ford's condemnation proceedings became effective recently when representatives of the Ford interests in Lima filed a $100,000 surety bond with Waldo Rose, clerk of courts.

At the time of the controversy over the strip of land from which the quarries company has been extracting stone, Judge H. W. Blachly ruled in favor of the railroad company, but decreed that a bond of $100,000 would be necessary before the restraining order would be effective, and that it would be held until the difficulties are settled.

In a $75,000 damage suit through which the temporary injunction was granted, representatives of Henry Ford alleged that the operations of the National Quarries Co., since the time they claimed ownership of the 10-acre strip north of the city, aggregates $1,000 a day. They support this allegation with an explanation that it will require an expenditure of upwards of $50,000 to raise a grade when a deep hole has been made.

The Ford interests further contend that the land virtually became part of the D. T. & I. holdings when Judge Jesse H. Hamilton ruled that a necessity existed, one of the essential points of a condemnation proceeding. The right of eminent domain was conceded by the quarries company.

Attorneys for the railroad company claim that the one remaining court angle of Ford's efforts to get the land in litigation, is the impaneling of a jury to fix a fair price for the 10-acre strip. It is understood that the quarries company want $350,000 for their holdings. In view of the fact that the case has been pending for longer than a year, it is likely that it will be assigned for early in September.

Counsel for the National Quarries Co. have already filed a plea to dissolve the injunction and allow the company to continue its operation at the property. The hearing on exceptions has been set for an early date.

Accompanying the motion asking dissolution of the restraining order is seen an effort on the part of the plaintiff to set aside the $75,000 damage suit filed by the railroad company. The answer sets out that stone contracts with the railroad had been fulfilled both before and after the date that the plaintiff in the damage suit came into actual possession of the land and that $25,000 had been expended in stripping it for quarrying operations.—*Lima (Ohio) News.*

Butler R. Davison

BUTLER R. DAVISON, vice president and director of J. K. Davison & Bro., of Pittsburgh, Penn., died recently at his home in Pittsburgh. Mr. Davison was an officer in one of the oldest and strongest sand and gravel producing companies in the Pittsburgh district, and a member of the National Sand and Gravel Association. He is survived by his brothers, George Mc Davison and Harry S. Davison.

"Empire State Gravelette"

THE *Empire State Gravelette* is a mimeographed publication issued by the Empire State Sand and Gravel Association, and conducted by John G. Carpenter, the secretary-treasurer of the association. It outlines its policy in the following announcement:

The *Gravelette* makes its initial appearance unsolicited and unheralded. If ten producers should write us giving their opinion of it, we would be pleased; if five of them should claim they had read it through, we would take hope; if two of them should say that it is worth while, we might issue another number sooner or later.

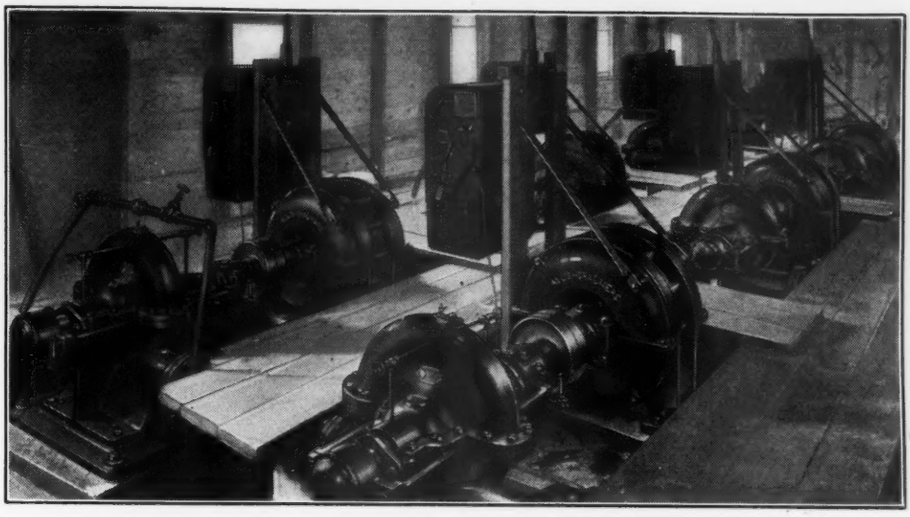
If you do not like the name, suggest a better one. It seems to keep within the bounds of modesty and to indicate that a lot of much needed "rough stuff" may be expected. If the outward appearance wounds your esthetic sense, remember that the rugged nut generally has the thickest meat. If its policy does not square with your notions, human criticisms will be considered. We make no claim to journalistic skill and modestly submit to the will of our readers. We will even accept contributions, subject to the usual editorial censorship. Future issues are contingent upon strikes, accidents, embargoes and causes beyond our control.

To Stop Fraud in Building Financing

NEW YORK builders of the better sort are trying to stop fraudulent practices that have grown up with the "shoe-string" financing of buildings in that city, according to Allen E. Beals of the *Dow Daily Building Reports.* The practices referred to are the signing of receipts for amounts not received, or for amounts greater than those received, by those furnishing material and labor to contractors. These receipts were used as a basis for floating loans, the loaning company refusing to lend until it could be shown that a certain amount had been expended on the building.

The recent slump in building in New York City is held to be partially due to the uncovering of such practices.

CENTRIFUGAL PUMPING UNITS
WHICH WILL HELP OUT IN THE HARD PLACES



6-8" types pumps with 125 h.p. motors sluicing earth for Toronto Reservoir Dam. Fred T. Ley & Co., Inc., Contractors.

Any process or undertaking requiring the use of centrifugal pumps can be materially helped or hindered by the kind of pumps and their proper application. Allis-Chalmers centrifugal pumps with Allis-Chalmers motors are the kind of units that help, and our representatives can assist you in their proper application. On two recent construction jobs contractors had to build large earth-filled dams, and Allis-Chalmers Centrifugal Pumping Units were selected for hydraulic sluicing service. The high reliability factor of our units was of great assistance in the satisfactory completion of the work and the contractors were highly pleased with the performance of the Allis-Chalmers Centrifugal Pumping Units of combined responsibility.

6-10" types pumps with 200 h.p. motors sluicing earth for dam for Northern N. Y. Utilities Inc. U. G. I. Co., contractors.

ALLIS-CHALMERS
MILWAUKEE, WIS. U. S. A.

News of All the Industry

Incorporations

Atlas Portland Cement Co. of Kansas. Increased capital in Oklahoma from $50,125 to $67,083.

Shearman Concrete Pipe Co., Inc., Knoxville, Tenn. Increased capital from $200,000 to $500,000.

Central Oolitic Stone Co., Bloomington, Ind. Increased capital stock from $250,000 to $375,000.

Lee Lime Corp., Dover, Del., $800,000. To quarry and mine limestone, etc. E. E. Craig, Dover.

Chenango Valley Sand and Gravel Co., Sherburne, N. Y., $30,000. J. F. and E. S. W. Paddleford, H. V. Owens.

Castone Corp., Little Neck, N. Y., $10,000. F. Hannigan, W. Hoffman and S. Gordon. To manufacture artificial stone.

Yosemite Portland Cement Corp., San Francisco, Calif. Increased capital from $3,000,000 to $3,500,000. (United States Corp. Co.)

Advance Stone Works, New York, N. Y., $50,000. A. Fasini, J. F. Sabbia. (Corr.: D. Epstein, 299 Broadway, New York.)

Long Beach Sand Co., New York, $200,000. M. Ankin, R. Moore, R. E. Tinsey. (Filed by Schlesinger & Krinsky, 299 Broadway, New York.)

Allied Concrete Products and Supply Co., Perth Amboy, N. J., $100,000. S. W. Bonk, M. Keak and H. E. Homond. (Atty., P. J. Quackenbush, Perth Amboy.) To manufacture cement products.

Quarries

M. J. Grove Lime Co., Stephens City, Va., set off their largest single blast recently. Over 25,000 tons of stone were dislodged following the shooting of 5 holes loaded with about 2300 lb. of dynamite. C. A. Cross is superintendent of the plant.

William Fister has completed the building of a quarter mile track connecting the county quarry at Viley Station, Ky., with the L. and N. railroad. Mr. Fister recently leased the quarry from Fayette county and will operate it as a private enterprise. Under terms of the lease the county receives 20 cents per ton for all rock sold and gets its road material at 80 cents a ton.

C. C. Doll and **M. Smith** have leased from John Easterly the quarry properties located at Frederick, Md. It is planned to develop the deposit under the firm name of the Eastern Sand and Stone Co. Crushers, conveyors and other equipment will be installed.

John W. Rice has engaged in business with office at 504 Hobart Bldg., San Francisco, Calif., as the San Francisco Rock Products Co.

Sand and Gravel

Ambrose Sand and Gravel Co., Denison, Tex., are operating their recently opened pits at capacity. About 30 cars are shipped daily to fill the heavy demand for paving and building.

Greenville Gravel Co.'s plant near Mechanicsburg, Ohio, through a series of cave-ins at the pit which made suspension of work necessary, has suffered a considerable loss.

River Sand and Gravel Co., San Francisco, Calif., plans erection of a small office building at the southeast corner of Sixteenth and Harrison streets.

Sparks Brothers are engaging in the sand and gravel business in Anacortes, Wash.

George **Krebs** is opening a sand and gravel pit on Cedar Creek, near Sandy, Ore.

Cement

Coplay Cement Mfg. Co., Coplay, Penn., has recently installed the first of three Polysius four-compartment tube mills. The mill, made in Germany, is the first of its kind in the United States.

Atlas Portland Cement Co., which has been prospecting in the Kunkletown, Penn., section for white clay for several years, has taken leases on several properties in Eldred township. The new holdings are adjacent to the thousands of acres of land the company owns between Saylorsburg and Kunkletown.

Lawrence Portland Cement Co., Northampton, Penn., have put in the foundation for what is said will be one of the largest kilns in the section. Burrell Engineering Co., Chicago, are in charge of construction.

Carolina Portland Cement Co., Jacksonville, Fla., has let the contract for erection of a warehouse on Phelps street to cost $29,000.

Federal Cement Co. has moved its offices in Indianapolis from 321 Hume-Mansur building to 518 North Delaware street.

Cement Products

Tennessee-Arkansas Gravel Co., Little Rock, Ark., has definitely decided to erect a plant for the manufacture of building tile and other cement products at Arkansas City, Ark. This will be a modern products plant equal to the capacity of the Memphis or St. Louis plants operated by the company.

J. S. Lockland is reported to have plans for the establishment of a concrete pipe and cement products plant at Buchanan, Va.

Kirkpatrick Sand and Cement Co., Birmingham, Ala., are planning the erection of a new plant and office building to include warehouse, display rooms, etc.

Montauk Sand and Gravel Co., Montauk, N. Y., is to add a cement products unit to their recently completed gravel plant. The chief product will be cement blocks which will go into the building of Montauk Beach.

Gouverneur Limestone Co., Gouverneur, N. Y., has added the manufacture of cement tile to the products from their cement products plant.

Bent Concrete Pipe Co. of Los Angeles, Calif., has opened an office at 204 Bank of Italy Bldg., Visalia, Calif., with A. A. Clark in charge.

Agricultural Limestone

H. H. McGovern has under development at Kalispell, Mont., a deposit of high calcium marl and travertine and is interested in securing information on new uses and operating equipment for these materials.

Washington Agricultural Chemical Co., Sedro-Woolley, Wash., has placed orders for grinding equipment for the manufacture of agricultural limestone and will soon begin production.

Salem, Ore. The supervisors of the state agricultural limestone plant near Gold Hill, at a recent meeting set a delivered price of $5.50 per ton for sacked and $4.75 for bulk limestone. The plant capacity is about 50 tons per day, all produced by prison labor.

Miscellaneous Rock Products

United Rock Asphalt Co., Albany, Ala., is developing asphalt deposits in Morgan county and will erect a mill near Flint, Ala.

Personals

C. L. Hudson, formerly with the Houston, Tex., office of the Merco Nordstrom Valve Co., San Francisco, Calif., has resigned his position.

Frank B. Ungar

Frank B. Ungar, for many years Chicago representative for the Ludlow-Saylor Wire Co. of St. Louis, has been transferred to the general offices of the company in St. Louis and appointed assistant to the general manager of sales. Mr. Ungar has been connected with the sales department of the Ludlow-Saylor Wire Co. for twenty-six years and is known to industrial buyers and operating men throughout the country.

H. C. Beckwith, for 11 years general manager of the Byers Machine Co., has resigned and will relinquish his executive duties in December, to make his future home in California. Mr. Beckwith will retain an official connection with the company as vice president and will continue to serve in an advisory capacity.

K. H. Talbot

K. H. Talbot has been recently appointed manager of cement sales of the Cowham Engineering Co., Chicago. Mr. Talbot was formerly with the Centrifix Corp. of Cleveland. Prior to this he was connected with the Koehring Co. at Milwaukee and the technical staff of the Universal Portland Cement Co. at Pittsburgh and Chicago.

E. D. Green, formerly with the Alabama office of the Portland Cement Association, has been appointed executive secretary of the Alabama branch of the Associated General Contractors. Mr. Green is a graduate of the University of Alabama and has had a wide experience in construction work.

S. McPherson, general secretary of the Institution of Quarry Managers, Birmingham, England, at the request of a number of brick works owners and managers, is to form an Institution of Brick Works Managers, whose purpose is for the discussion of technical and geological questions relating to brickmaking and other matters pertaining to the control of the brick works and the welfare of members.

Sewell L. Avery, president of the U. S. Gypsum Co., was elected a director of the recently organized Illinois Association for Criminal Justice. This body was founded to fight crime in Illinois and is composed of some of the most prominent men and women of that state.

Kay M. Grier, advertising manager, has been named assistant to the president of the Blue Diamond Materials Co., Los Angeles, Calif., producer and distributor of building materials.

Obituaries

Claude F. Chard, for several years Cleveland district sales manager of the Austin Co., engineers and builders, Cleveland, was killed in a recent automobile accident. Mr. Chard graduated from Purdue University in 1910. He was a member of Triangle Fraternity and of the Cincinnati Club of Cincinnati. Before his association with the Austin Co. in 1918 Mr. Chard was with the Westinghouse, Church, Kerr Co. of New York.

Manufacturers

McMyler-Interstate Co., Cleveland, Ohio, announce the following new distributors for their equipment: W. H. Worden Co., San Francisco, for the states of California, Arizona and Nevada. C. F. Wolfradt, formerly Pacific coast branch manager for the McMyler-Interstate Co., became affiliated with the Worden Co. August 1. Hofius Steel & Equipment Co., Seattle, for the states of Washington, Oregon and Idaho, and Thurman G. Frazee, First National Bank Bldg., Houston, Tex., for the state of Texas.

Fort Pitt Mine and Equipment Co., Pittsburgh, Penn., announces that it has succeeded the G. M. Johnson Co., Jeanette, Penn. The company has been completely reorganized with entirely new personnel and manufacturing and sales policies. The new officers are Frank J. Lanahan, president; E. W. Wright, vice president; P. J. Meehan, secretary and treasurer; M. E. Nolan, general sales manager, and Louis E. Endsley, consulting engineer.

W. A. Jones Foundry and Machine Co., Chicago, announce the appointment of Ralph L. Shaw as Milwaukee district representative to fill the vacancy created by the resignation of Fred E. Holtz.

Morris Machinery Co., Baldwinsville, N. Y., have moved their Cleveland office to 1367 East Sixth street.

Anchor Concrete Machinery Co. anounce that the main sales office will be located in their new office building at Adrian, Mich., which will soon be completed. A factory branch will be also maintained at Columbus, Ohio, to serve the neighboring territory.